VOLUME 30 NUMBER 8 AUGUST, 1947

AMERICAN JOURNAL OF OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

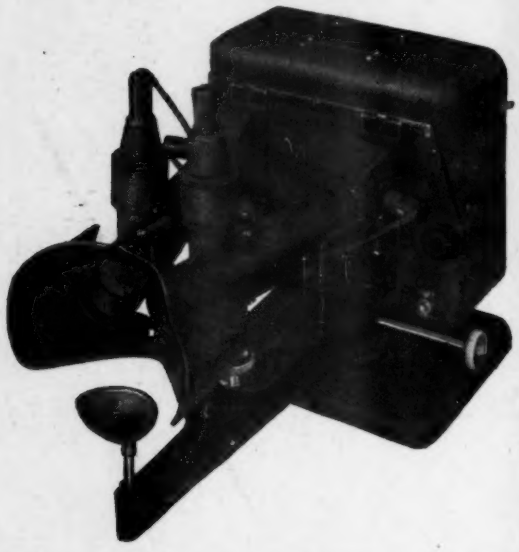
CONTENTS

DEPARTMENTS

For complete table of contents see advertising page XI

Subscription price in United States ten dollars yearly. In Canada and foreign countries twelve dollars. Published monthly by the Ophthalmic Publishing Company. Subscription and Advertising Office: 700 North Michigan Avenue, Chicago 11, Illinois. Entered as second class matter at the post office at Menasha, Wisconsin.

The Royal Rotoscope



The Royal Rotoscope improved and modern in every way gives you the desirable features that have proved so effective in visual training procedures.

Complete accessories accompany the new Royal "50" Rotoscope. A wide variety of targets printed on durable celluloid, five pairs of auxiliary lenses and two pairs of color filters, all in a convenient target case, also a modern training technique that gives you a guide to follow in getting the best results.

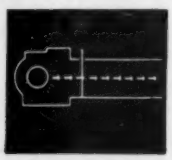
The advantages of the Royal "50" are illustrated, and described briefly here, but the real story is in the results obtained in your office.

Ask a Riggs representative about the Royal "50".

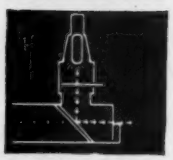
Riggs Optical Company

Distributors of Bausch & Lomb Ophthalmic Products
General Offices, Chicago, San Francisco
Branches in Principal Western and Mid-Western Cities

A Few Royal Features

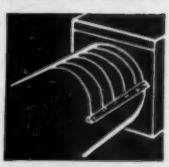


Lights *behind* targets—vital in providing clear definition with light evenly diffused. Control of this light is independent for each eye—a helpful feature in training.

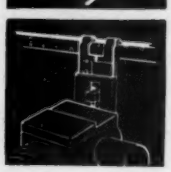


Removable light towers for observing patients' eyes. The lights in these towers also make possible constant light adaptation. Slots receive targets for *near point testing and training* —valuable for training accommodative responses.

Variable control. Lighting intensity, alternate flashing and speed are all under your absolute control with these easily-manipulated controls on the Royal. Stage revolves clockwise and counter-clockwise automatically. (Flashing speed *doubled* by special switch.)



Target slots calibrated in quarter diopters, making possible *instant changes in the stimulus to accommodation.* Changing targets from infinity slot to one of the other positions is equivalent to adding plus or minus lenses.



Base in and base out scales provide quick, easily-read, *accurate measurements* for infinity and at near. Base up and base down readings easily taken as target tubes are lowered and raised. Break and recovery points can be quickly determined.

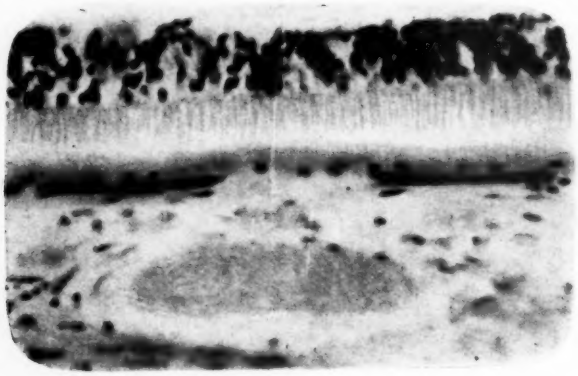


FIGURE 5

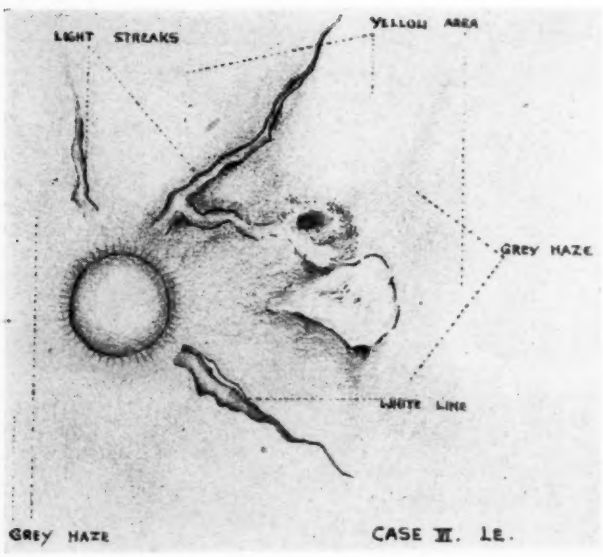


FIGURE 4

FIG. 4. (KLIEN). SKETCH OF POSTERIOR SEGMENT OF ENUCLEATED LEFT EYE OF CASE 6.

FIG. 5. (KLIEN). EARLY DEFECTS AND INTENSE STAIN OF BRUCH'S MEMBRANE. (HEMATOXYLIN-EOSIN STAIN. MAGNIFICATION ×450.)

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 30 AUGUST, 1947 NUMBER 8

ANGIOID STREAKS*

A CLINICAL AND HISTOPATHOLOGIC STUDY

BERTHA A. KLIEN, M.D.
Chicago

Angioid streaks, like all rare lesions of the fundus, pose an especially fascinating problem in the correlation of clinical and histopathologic findings. This is the third histologic report in the ophthalmic literature, and concerns the two eyes of the same individual—one in an earlier stage, the other in a well-advanced stage of this disease—which afford an opportunity to add several new facts to the present knowledge of angioid streaks. Five clinical cases are also presented, two with associated pseudoxanthoma elasticum of the skin, and one with associated osteitis deformans (Paget's disease). Special emphasis will be placed upon the correlation of the rather varied clinical details in the different stages of the disease with the underlying histopathology.

Almost five decades of speculation about the pathologic process in angioid streaks passed between the first description of the clinical picture by O. Plange,[1] in 1891, its naming by H. Knapp,[2] in 1892, and the first histologic study, in 1938, by J. Boeck[3] of the I. Eye Clinic in Vienna. From this first report it was obvious that one of the outstanding histologic features of this condition was breaks and dehiscences of the lamina basalis of the choroid (Bruch's membrane). The conclusion, however, that these breaks and dehiscences represented the essential basis for the clinical visibility of the streaks was erroneous. Breaks in Bruch's membrane have not been unknown. They have been discovered in histologic sections of a variety of conditions such as high myopia, arteriosclerosis of the choriod, and disciform macular degeneration, in all of which only a small proportion of the breaks or none at all were visible clinically. It was realized (Hagedoorn,[4] Klien[5]) that a mere defect in the lamina basalis alone would not be sufficient to produce the clinical picture of angioid streaks, but that something further would be necessary; that is, an alteration of the membrane which would render it opaque and make the defects visible by contrast.

Hagedoorn,[4] in the second histologic study of angioid streaks in 1939, proved painstakingly and conclusively that there is a diffuse degeneration of the elastic fibers of Bruch's membrane, which presumably impairs its translucency and makes ruptures in the degenerated membrane visible by contrast. A suggestion of this kind, but without actual proof, had been already made by Groenblad,[6] who emphasized for the first time that the frequent association of angioid streaks and pseudoxanthoma elasticum of the skin may point to a systemic degeneration of the elastic tissues of the body. Prior

* From the Department of Ophthalmology, Northwestern University Medical School. Read before the Chicago Ophthalmological Society, February 17, 1947.

to Groenblad's publication, this association had been noted as far back as 1903, by two French authors, Hallopeau and Laffitte,[7] but was not further emphasized.

The clinical picture of angioid streaks has been presented so often and so well that a general description of it is omitted here. Three of the following reports of

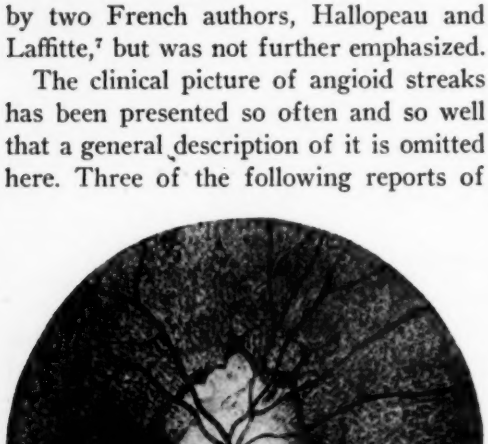


Fig. 1 (Klien). Right eye of Case 1. Very early stage of angioid streaks. There is an incipient, opaque, yellowish area above disc.

patients, however, are accompanied by illustrations depicting the disease in early, advanced, and late stages, to facilitate reference to some of the clinical details in the course of the histopathologic description.

Case reports

Case 1. B. A., a man, 56 years of age, entered the eye clinic of Rush Medical College with the complaint of presbyopia. The corrected vision in each eye was 1.2 and J1. The external ocular findings, optic discs, and retinal vessels were normal. Both discs were surrounded by a circle of reddish-brown angioid streaks from which numerous radial extensions originated. There was no visible macular lesion in either eye, but the posterior polar regions appeared finely granular. The right fundus is shown in Figure 1. Between the disc and the upper portion of the circular angioid streak, there was an opaque yellowish discoloration. Within the broadest streak on the temporal side there was a fine lighter-red pattern, as if of visible choriocapillaris.

During five years of observation, there was no deterioration of the central vision. The appearance of the maculas remained unchanged, but in the inferior nasal periphery of the right eye, there developed a yellowish-gray crescentic area with discrete and confluent white dots. The visual fields revealed some enlargement of the blind spots, but were normal otherwise.

There was no pseudoxanthoma elasticum. The patient suffered from coronary vascular disease. Blood pressure was 130/80 mm. Hg.

*Case 2.** Sch. E., a woman, aged 40 years, entered the eye clinic of Rush Medical College complaining of bilateral, progressive loss of vision for the past two years, the onset of which was characterized by marked metamorphopsia. At the age of nine years, she had also noted cutaneous lesions in the form of small yellowish papules at the base of the neck. After the age of 30 years, similiar lesions developed in the groins and the axillae. There was no history of ocular trauma or inflammation. The family history was irrelevant. Corrected vision was: R.E., 0.5; L.E., 0.3—1. The external ocular findings were normal, as were the optic discs and retinal vessels. In the right fundus, there was a semicircular arrangement of reddish-brown angioid streaks with characteristic ragged outline. Radial extensions emerged from several places

* This patient was presented by Dr. Nomland and Dr. Klien at the Chicago Dermatologic Society, October 19, 1932.

and could be followed far into the periphery. Near the temporal margin of the disc there was a grayish, poorly defined choroidal lesion, 3 by 4 disc diameters in size, with irregular pigment inclusions and some superimposed connective tissue.

In the left fundus (fig. 2), there were similar but more advanced pathologic findings. The macula was occupied by a gray, ill-defined plaque, 1 by 1 disc diameters in size, into which a large reddish-brown streak seemed to merge. It was almost surrounded by a zone of fine yellowish dots of moth-eaten appearance. Between disc and macula there was a spiderlike formation of streaks, and in its neighborhood, there were several small, deep, flat hemorrhages. Within this broad streak, choroidal vessels of normal appearance were distinctly visible. There were also several areas of pigment proliferation and of diffuse opaque yellowish discoloration. In several light-colored areas, choroidal vessels were distinctly visible, and one of them, above the disc, appeared sclerosed.

In the periphery of both fundi there were fine, diffuse, granular pigmentary disturbances, and, in general, the posterior polar regions between the streaks had a peculiar veil-like haze.

The patient was observed for two years, during which time hemorrhages recurred around the macular lesions. One retinal vessel, crossing a large streak, was, at first, observed to have a sheathing with a grayish-black pigment. This disappeared in the course of several months.

The patient had an essential hypertension with blood pressure around 158/88 mm. Hg. The blood-cholesterol level was normal. The diagnosis of bilateral angioid streaks with associated pseudoxanthoma elasticum was made, and the diagnosis of the skin lesion was confirmed by Dr. R. Nomland in the Department of Dermatology. Dr. Nomland said that a biopsy specimen of the skin stained with orcein and hematoxylin showed, in circumscribed areas in the subpapillary and middle cutis, elastic fibers occurring in coils, which were thickened, broken, and fragmented. These fibrils took an intensive blue stain with hematoxylin and

Fig. 2 (Klien). Left eye of Case 2. Advanced stage of angioid streaks. There are beginning macular lesions in the form of gray area surrounded by yellowish spots with moth-eaten outline. Sclerotic choroidal vessel visible above disc. Choroidal vessels visible within broad angioid streak.

turned dark brown under the influence of silver nitrate, suggesting the presence of calcium (Nomland and Klien[8]).

Several years later Finnerud and Nomland[9] published further work on pseudoxanthoma elasticum, in which they demonstrated the presence of calcium in the form of the phosphate by staining methods, quantitive chemical analysis, and microchemical means. This is especially mentioned here because of the parallelism between skin and eye findings. Although the presence of calcium is only secondary to the primary elastic degeneration in skin and eye, it evidently plays a role in producing the great variety of findings

which characterize the later stages of the ocular disease.

*Case 3.** N. A., a man, 42 years of age, was sent by his dermatologist for ocular consultation. At the time of his first visit 15 years ago, he complained of failing left vision of several years' duration. He had an extensive pseudoxanthoma elasticum of the skin and attacks of purpura

Fig. 3 (Klien). Left eye of Case 3. Late stage of angioid streaks. There is a disciform macular lesion, extensive opaque yellowish color with pigment flecks below disc.

hemorrhagica. The right vision was 1.2; the left, 4/200. The external ocular findings, discs, and retinal vessels were normal. There was extensive angioid-streak formation without a macular lesion in the right fundus. The left fundus is pictured in Figure 3. Within the broadest streak, between macula and disc, several choroidal vessels were visible. Many of the streaks had light-colored centers but lacked visible choroidal details. There was a disciform macular lesion. Adjoining the inferior margin of the disc, there was an opaque yellowish-white area, studded with numerous small brown dots, which extended far into the lower fundus periphery and on the temporal side followed the outline of a broad radial angioid streak.

A recent report from the patient states that the right eye also has now lost its central vision and that the pseudoxanthoma covers most of the body. The outbreaks of purpura have become less frequent, but two years ago an enlargement of the spleen and polycythemia vera were discovered.

Case 4.† J. S., a man, aged 49 years, entered the eye clinic of Rush Medical College complaining of bilateral progressive loss of vision for the past two years. For the past seven years he had noted a slowly advancing enlargement of the head with subsequent impairment of hearing and a diminution of his height. A diagnosis of osteitis deformans was made and confirmed.

At the time of the first visit, corrected vision was: R.E., 0.4 and J1 at 6 inches; L.E., 0.1 and no Jaeger. There was very high bilateral mixed astigmatism. Aside from an extremely wide interpupillary distance, the external eye findings were normal. Both optic discs showed a marked typus inversus, but they and the retinal vessels appeared normal. Around both discs there were incomplete circles of angioid streaks, which varied in color from reddish-brown to yellow. There were a few radial extensions. In the left eye, there were scattered deep hemorrhages, which appeared to be in the same level as the streaks. The fundus picture in both eyes was, however, dominated by the macular lesions, which consisted of well-defined, slightly prominent masses with inclusion of brown pigment.

There was a large paracentral scotoma in the right field, a central scotoma in the

* Dr. O. H. Foerster, Milwaukee, who has had this patient under observation for the past 15 years, has supplied all but the ocular data.

† This patient was presented at the Chicago Ophthalmological Society, April 4, 1941.

left field, and a moderate, irregular, concentric contraction of the peripheral visual fields.

During four years of observation, there were repeated deep hemorrhages in and around the macular lesions and the vision deteriorated to 1/200 in the right eye; 2/200 in the left eye. There was a marked increase of phosphatase in the blood (24 Bodansky units as compared to a normal of 5 to 8), a finding which is of great differential-diagnostic importance, as it is already present in the subclinical forms of osteitis deformans.

In addition to the symptoms of osteitis deformans, the patient had marked generalized arteriosclerosis, especially tortuous and thickened temporal arteries. Enlarged veins and arteries had eroded the skull in places, and one large vein over the right frontal area was pulsating.

The association of angioid streaks and Paget's disease was first emphasized by Terry,[10] who collected four cases from the literature and added five of his own. Two more cases have since been reported by Lambert,[11] and one by Morrison.[12] This association may be much more frequent than reports in the literature lead one to believe, because in many reports of Paget's disease, the patient's defective vision is stated without investigation of its cause. Two of the most interesting reports in this connection concern two patients with osteitis deformans and multiple calcium deposits in various, otherwise normal, soft tissues and inner organs (Wells and Holley,[13] Seligman and Nathanson[14]). Calcifications of healthy tissues are difficult to explain, and it is usually assumed that circulatory disturbances favor it. According to some authors, the increased amount of phosphatase may have a close causal relation to the deposition of calcium. There is rarely a hypercalcemia in Paget's disease, although the calcium-phosphorus balance is said to be disturbed. As some one expressed it: "The bone lesions surrender calcium to the tissues." It is interesting that the deposition of calcium, whenever present, was found in otherwise healthy tissues. It could, therefore, also be deposited in an otherwise healthy Bruch's membrane leading to fragility and angioid streaks, without preceding degeneration of elastic tissues. So far no association of Paget's disease with pseudoxanthoma elasticum, which would point to a selective degeneration of the elastic tissue, has been reported. Angioid streaks and Paget's disease have in common, however, frequent association with marked generalized arteriosclerosis, and circulatory disturbances on this basis may predispose to calcification of various tissues. Each patient with angioid streaks, especially those without associated pseudoxanthoma elasticum, should be tested for the subclinical forms of osteitis deformans by determining the phosphatase level in the blood, and each patient with Paget's disease should be submitted to a periodic fundus examination.

Case 5. E. G., a woman, aged 62 years, entered the eye clinic of Rush Medical College with the complaint of presbyopia. The vision in the left eye had been poor all her life.

Corrected vision was: R.E., 0.8 + 3 and J1; L.E., hand movements and correct light projection. External ocular findings in the right eye were normal. The cornea of the left eye was smaller than normal with numerous medullated nerve fibers. There were congenital nuclear and anterior-polar cataracts and between the 11- and 12-o'clock positions, vitreous herniated slightly through a congenital coloboma of the lens. The fundus was not visible.

The right optic disc was normal. There were several circular angioid streaks around it with three radial extensions, the

longest of which merged peripherally with a dull-red area, which was surrounded by a grayish discoloration. The macula was normal.

There was no pseudoxanthoma elasticum of the skin. This case is included because of the associated malformations of the other eye. Malformations in association with angioid streaks are mentioned by Boeck, who found vascular malformations in the form of opticociliary arteries in 3 of 14 cases with angioid streaks. Malformations were also found in our Case 4.

Case 6. St. J., a man, 53 years of age, was admitted to the neurologic service of Passavant Hospital in a serious condition, with the history of attacks of dizziness and speech difficulty of six months' duration. At this time his eye grounds were examined by Dr. Derrick Vail, who found angioid streaks in both eyes, a well-developed disciform lesion in the left macula, and a similar incipient lesion of the right macula. No fundus paintings or photographs were made because the patient was moribund.

Two reports of previous ocular examinations were obtained, one from (Dr. Gradle's office) 12 years ago, which mentioned an active, elevated lesion in the left macula with fresh hemorrhages, and a lesion resembling a healed choroidal rupture in the right fundus. Vision at that time was: R.E., 1.5; L.E., 10/200. Years later the patient was examined in the Mayo Clinic, where the diagnosis of bilateral angioid streaks was made.

The salient features of the general autopsy report were: arachnoiditis with cerebral hemorrhages, severe arteriosclerosis with ulceration and calcification in the aorta, and mild nephrosclerosis. There was no pseudoxanthoma elasticum of the skin.

Immediately after death, injections of a 10-percent solution of formaldehyde were made into the orbital tissues around the eyeballs and, after enucleation, both globes were placed in a 10-percent neutral solution of formaldehyde for fixation. The external measurements of both eyeballs were equal and normal. Prior to the embedding, the right globe was cut into an anterior and posterior half, considering the possibility of photographic registration of any visible details of the eye ground. The retina, however, although in situ, was completely opaque and drawn into numerous minute radial folds around optic disc and fovea, making choroidal details invisible. The left eye was opened by a superior and inferior section. All intraocular structures were in situ. In the macula there was a slightly elevated whitish lesion, measuring 1 disc diameter, in the vertical, and 1½ disc diameters in the horizontal diameter (fig. 4). It was surrounded by a pigmented zone which was densest and broadest above and nasally, where it measured 1 disc diameter. In various portions of the fundus, there were lighter, yellowish areas, especially above the disc and the disciform macular lesion; other portions, particularly within 3 to 4 disc diameters around the disc and below the macular lesion, gave the impression of a grayish veil. Adjacent to the disc, there were fine radial folds of the retina which obscured the deeper-lying details in this area. There were two distinctly visible angioid streaks; one, broad and short, radiated from the peripapillary area into the inferior temporal sector. The broad portion had a yellowish color and dark, ragged outlines, and in only one place, along the upper outline, there was a light accompanying line. At a distance of about 2 disc diameters from the optic papilla, the streak faded out as a narrow grayish-brown line. The other visible streak radiated from the peripapillary area of the superior temporal sector and could be fol-

lowed far out into the periphery as a ragged yellowish band, with brown borders in several places. A short branch from this upper streak joined the disciform macular lesion. The superior calotte, which was removed from this globe, contained the end of this angioid streak, and was embedded in paraffin, while the main portions of both eyes were embedded in celloidin.

Histologic findings. Both eyes were sectioned from above downward. Of the right eye only the posterior half has, as yet, been sectioned. The anterior segment of the left eye was normal. There were no calcium deposits in the corneal or conjunctival epithelium. The pathologic findings in the posterior segments of both eyes were similar, only further advanced in the left eye, and they shall be discussed together as far as possible.

Since the pathology of angioid streaks centers around the lamina basalis of the choroid, a few general remarks about this structure are in place. The inner lamella of this membrane is of a homogeneous cuticular type and is considered as the basal membrane of the pigment epithelium. The outer portion consists of a plexus of fine elastic fibers which are connected with the abundant elastic fibers of the capillary interstices in the choroid. In the posterior segment these two portions are joined together by an invisible cement substance. In most sections the cuticular layer is more difficult to see than the elastic lamella.

In the sections of both eyes, stained with hematoxylin-eosin, attention was focused immediately upon the deep-blue stain of the lamina basalis, which stood out as a broad, easily visible line throughout the posterior polar region. Toward the equator this deep stain ceased to be homogeneous but became spotty and in the periphery the membrane had an inconspicuous normal appearance.

There were numerous breaks in the membrane, which increased in number toward the posterior polar regions. Some of these were quite small and affected only the outer elastic portion of the membrane, while the choriocapillaris under

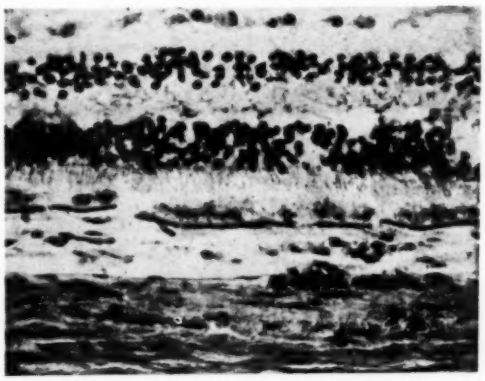


Fig. 6 (Klien). Paraffin section, hematoxylin-eosin, ×450. Multiple fractures, mostly artefacts, of Bruch's membrane, showing its extreme fragility.

them, the inner cuticular portion, pigment epithelium, and retina were completely intact. The edges of the breaks were often abrupt with slightly frayed ends (fig. 5); others were oblique with slanting margins (fig. 8). Visible connections of some of these edges and of entire short fragments with the elastic network of the choriocapillaris had in many instances caused their displacement backward. In one area an artefact had resulted in some tangential sections of Bruch's membrane in a portion, containing narrow ruptures, which had the almost identical shape of the clinically visible streaks (fig. 9).

In addition to these narrow ruptures there were wide gaps in the lamina basalis over still well-preserved choriocapillaris (fig. 5), within which choroidal blood vessels would be visible clinically if the pigment epithelium did not carry much pigment. The deep hematoxylin stain of the membrane suggested the presence of calcium deposits, which were definitely

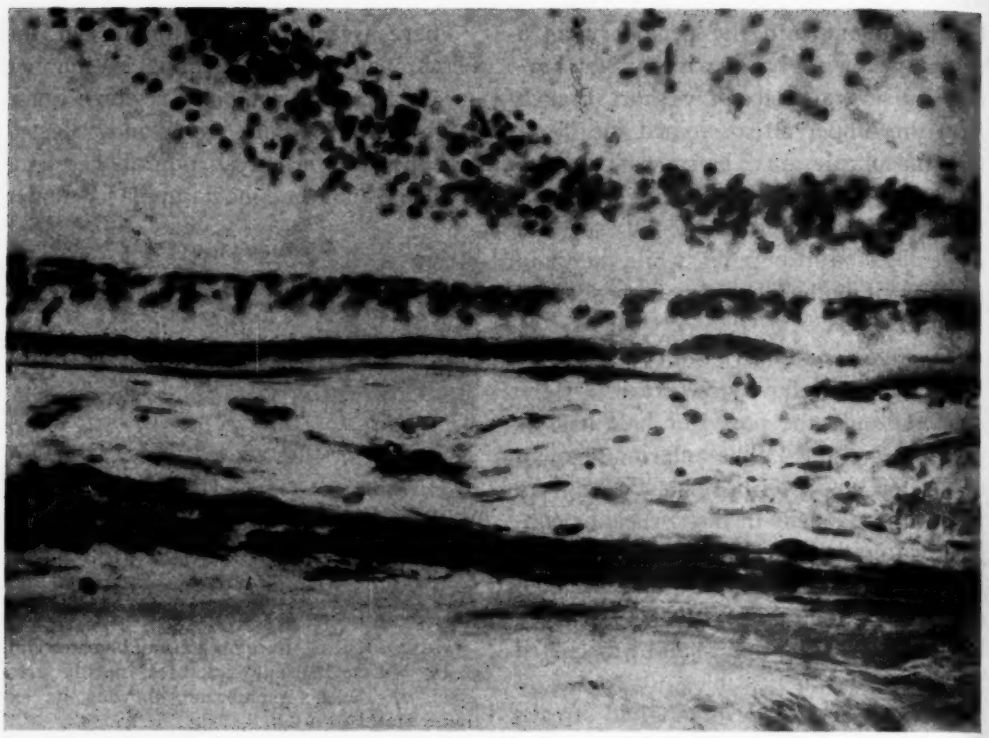


Fig. 7 (Klien). Spotty black stain of Bruch's membrane with Kossa test for calcium (×400). Thick cuticular layer under pigment epithelium.

demonstrated by a positive Kossa reaction (fig. 7). With this method, entire fragments, especially those dislocated into the deeper layers of the choroid, stained diffusely black, while in the portions of the membrane without gross lesions, the black stain indicating calcium was as spotty as the hematoxylin stain of corresponding areas in adjoining sections. In sections stained with orcein, the most peripheral portions of the lamina basalis took the elastic stain homogeneously, while a spotty distribution of it appeared farther back, and in the posterior polar regions long stretches of the membrane stained only faintly. By careful study of adjoining sections, it was possible to decide that the same portions of the membrane, which took a heavy hematoxylin stain and scarcely stained with orcein, indicated an almost complete degeneration of the elastic fibers in these places. In other portions, which stained well with orcein, high magnifications revealed wavy, curly, and clumplike elastic fibers, particularly at the margins of some breaks. The fragility of the membrane, which must be intensified by the calcium deposits into the degenerated elastic portion, was well demonstrated by a very thin paraffin section (fig. 6) in which multiple, obviously artificial ruptures occurred.

Two factors may be responsible for the early calcification of the membrane. One is the affinity of degenerated elastic tissue for calcium salts, which is well known in general pathology; the other is the serous extravasation, due possibly to irritation of the choroidal capillaries, which was found in all of the histologic specimens of angioid streaks and which produces

bleblike detachments of the pigment epithelium from Bruch's membrane (fig. 8), and which may act similarly to serous fluid following circulatory disturbances in other tissues—a condition known to favor deposition of calcium.

Another special stain that gave a positive reaction in the lamina of both eyes was the Turnbull blue stain, one of the most reliable tests for the presence of iron. The lamina of the right eye stained faintly blue, that of the left eye intensely blue throughout the posterior polar region; while in a control eye with extensive posttraumatic retinal and subretinal hemorrhages, the lamina remained unstained. This, and the fact that the only retinal hemorrhage was found in the right eye with the less-advanced stage of the disease and the weaker iron stain in the lamina, suggests that not local hemorrhages but other metabolic disturbances are the cause for the deposition of iron salts in the lamina.

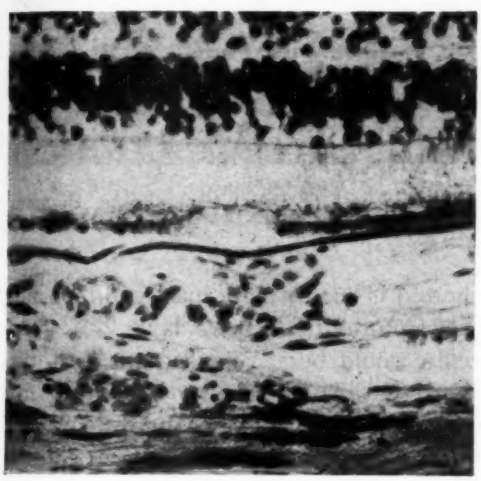


Fig. 8 (Klien). Oblique break in and beginning dislocation of small fragment of Bruch's membrane. Serous fluid under pigment epithelium. Choroid and retina normal.

The structure which next to Bruch's membrane showed the most obvious changes was the pigment epithelium. While it was normal over many of the small ruptures, it became irregular over the larger dehiscences, and small groups of its cells lost their pigment content, mostly without disruption of its continuity.

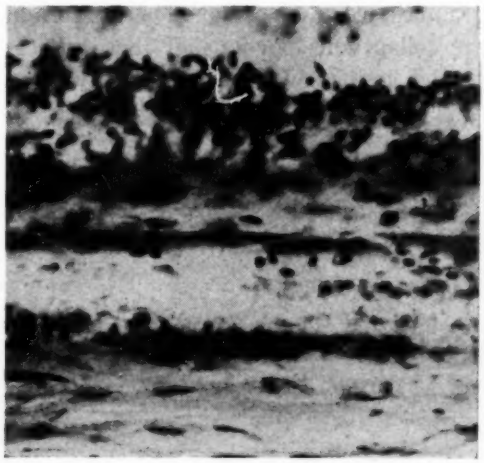


Fig. 9 (Klien). Incidental tangential section of Bruch's membrane with cracks of similar shape as those clinically visible.

Through many breaks in the lamina basalis, capillaries and fibroblasts had grown between it and the pigment epithelium, mixing with new glial tissue and forming crestlike elevations which could be followed through many sections running alongside the ruptures of Bruch's membrane (fig. 10). A similar, newly formed tissue, arranged in mounds, occupied the left macular area, where it contained some amorphous hyalin and a plate of bone.

It was interesting to note that, under these hypertrophic lesions, Bruch's membrane was unusually well preserved and that the newly formed tissue preferred to grow upon the still-preserved membrane as a base rather than to fill the gaps over the ruptures (fig. 10). Most of the concentric lesions around the optic discs consisted of these hypertrophic streaks

rather than the simple ruptures. Although rarely missing, the pigment epithelium over these crests and mounds was usually degenerated into flat, nonpigmented cells. At the corners of some of these crests, granular calcium or amorphous hyalin granules were deposited. The latter and the collagenous portions of these hypertrophic lesions were brought out well by the Van Gieson stain. There were also extensive areas within which a homogeneous, deeply pink-staining layer of cuticular appearance and of slightly varing thickness was found between the lamina and the pigment epithelium. In the left eye they corresponded to the light, yellowish segments of the fundus sketched in Figure 4. Circumscribed excrescences of this cuticular substance covered here and there small ruptures of the lamina. Another type of faintly pink-staining, somewhat granular substance, underneath bleblike detachments of the pigment epithelium, was interpreted as slightly coagulated serous fluid.

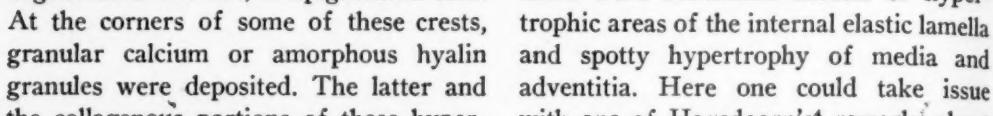


Fig. 10 (Klien). Hypertrophic lesions accompanying dehiscences of Bruch's membrane. Pigment hyperplasia and hyalin deposits at extreme left.

The choroid appeared normal under the unbroken membrane and under small ruptures. Under more extensive dehiscences and especially under the hypertrophic lesions, the capillary layer was missing and in many places fibroblastic granulomas had formed around displaced calcified fragments of Bruch's membrane. Many of the choroidal and posterior ciliary arteries were normal; in others there were occasional defects or hypertrophic areas of the internal elastic lamella and spotty hypertrophy of media and adventitia. Here one could take issue with one of Hagedoorn's[4] remarks about the choroid. He says (p. 947): "The choroid is surprisingly inactive in closing the ruptures of Bruch's layer." A good reply would be: "Why expect it of the choroid?" There are no cells in the choroid which are vitally interested in an intact lamina basalis. The pigment epithelium is the structure whose health and continuity, so important for the visual function, is endangered by damage to the lamina, and, indeed, much of its above-described activity could be interpreted as reparative.

The retina appeared normal except over some of the hypertrophic lesions, where the first and second neurons were extensively damaged. There was one small subretinal hemorrhage, temporal to the macula of the right eye. Sclerosis of the retinal arteries was even less marked than that of the ciliary arteries. The optic nerves were normal excepting several hyalin bodies in the temporal half of the left nervehead.

Summary

The anatomic study of two eyes with angioid streaks confirmed, on one hand, previous findings made by Boeck and Hagedoorn; on the other hand, it permitted the addition of several new observations, mainly because our specimens were unusually well preserved and because a detailed sketch of the posterior segment of one of the enucleated eyes facilitated a certain amount of direct correlation of the macroscopic and microscopic picture.

Previously recorded basic findings confirmed by our study are:

1. The diffuse degeneration of the elastic portion of Bruch's membrane, which leads to ruptures and dehiscences and may, as such, suffice to render the membrane opaque. A pertinent example of an ocular lesion in which a normally transparent tissue becomes opaque through degeneration of elastic fibers is the pinguecula.

2. The coexisting vascular disease, which in the eye affects mostly the posterior ciliary and choroidal vessels. It was found by both Boeck and Hagedoorn. However, Hagedoorn's statement, that the picture of the sclerotic arteries in eyes with angioid streaks differs from that in other eyes with simple choroidal sclerosis, can be accepted only with reservations. Hagedoorn's patient had an arterial hypertension of 200/140 mm. Hg at the age of 48 years, and the uniform thickening of the media and internal elastic lamella of the ciliary and choroidal arteries in his patient goes well with this clinical symptom. In both of our specimens the picture was that of the simple senile, involutionary type of sclerosis, characterized by spotty but often considerable hypertrophy of adventitia and media, and by a slightly rarefied, or normal, or occasionally thickened, internal elastic lamella. The clinical findings, in a number of patients with angioid streaks, of marked generalized arteriosclerosis or arteriosclerotic heart or cerebral disease without arterial hypertension, favor the conception of a premature senile sclerosis.

3. The positive iron stain of the lamina basalis in the posterior polar region was also obtained by Hagedoorn but not by Boeck, who used a less reliable staining method. In our case it was more pronounced in the eye with the more advanced stage of the disease, indicating that the iron salts are deposited later than the calcium salts.

Our own observations concern mainly the morphology of the early degeneration and ruptures of Bruch's membrane and the correlation between clinical and histologic lesions.

1. The earliest ruptures were limited to the elastic portions of the membrane, leaving its cuticular layer, the pigment epithelium, and the overlying retina completely intact.

2. The early defects in the membrane were of two kinds, namely, abrupt vertical severances of the appearance of true breaks (fig. 6) and oblique dehiscences (fig. 8), depending, perhaps, upon whether the break occurred in a portion which was already calcified or in one which had undergone, as yet, only a degeneration of the elastic tissue.

3. A definite proof of the calcification of the membrane was obtained through a positive Kossa stain. The calcification of the membrane in the earlier stages is as spotty (fig. 7) as the elastic degeneration shown by the orcein stain.

4. A dislocation of the edges of the breaks or of entire calcified fragments of the membrane into the deeper layers of the choroid was observed in many places, brought about by their intimate connection with the elastic fibers of the chorio-

capillaris. During this process of dislocation, the first irritative response from pigment epithelium and choriocapillaris seems to appear, which later on gives such variety to the picture. The frequent and often considerable separation of the pigment epithelium from Bruch's layer was caused in different places, by three different kinds of material: (1) A cuticular substance produced by the epithelium cells themselves; (2) a serous extravasation from the choriocapillaris; or (3) a mixture of glial and fibrous tissue with capillaries, derived from pigment epithelium and choroid, respectively.

The correlation of clinical and pathologic findings is based partly upon our present knowledge of similar or analogous conditions already correlated in this manner; partly upon the direct comparison of details in the gross drawing and the corresponding place in the histologic sections of Case 6. On this basis correlation with histologic findings of the following clinical details can be made:

1. The early streaks of reddish-brown color, some with visible choroidal details between their outlines. They appear histologically as simple ruptures or dehiscences in a degenerated lamina basalis. Depending upon the age of the rupture, choriocapillaris or larger choroidal vessels are clinically visible within them. Their color is a lighter or darker red, depending upon the pigment content of the still intact, if not normal, pigment epithelium and that of the choroidal stroma. The adjacent fundus is not discolored, but merely not transparent (fig. 1 and fig. 5).

2. Reddish- or grayish-brown streaks with light accompanying lines as shown in the drawing (fig. 4). In the corresponding place in the histologic sections, and in numerous other places, there were ruptures in Bruch's membrane which were accompanied by linear crests of newly formed tissue between pigment epithelium and lamina basalis. The hyalin deposits at the margins of some of these crests would intensify the light appearance of these hypertrophic streaks clinically.

3. Yellowish streaks (fig. 4) with or without dark or light accompanying lines. Through many adjacent sections narrow but thick, avascular, cuticular formations could be followed over narrow ruptures of the lamina, which clinically had the yellow color of drusen. The pigment epithelium was rarely missing over them, but had lost most of its pigment content and often consisted of only one layer of flat degenerated cells.

The most interesting correlations could be made regarding the appearance of the fundus in general. The two extremes in this respect were the diffuse, opaque, gray and diffuse, opaque, yellowish areas.

The gray areas corresponded to the layers of homogeneous, deeply pink-staining substance between intact pigment epithelium and lamina, which appeared to be due to an overproduction of cuticular substance similar to the basal membrane of the pigment epithelium and the well-known drusen. In the lamina covered by this substance, there usually were many ruptures, and one was reminded of nature's attempts to maintain continuity as, for instance, in the cornea, where endothelial cells become overactive over tears of Descemet's membrane, producing thick layers of a Descemet-like substance and endothelogenous connective tissue. The epithelium over these areas was deeply pigmented and together with the two opaque layers under it—the degenerated elastic lamella and the thick cuticular layer—it appeared clinically as an opaque gray haze (figs. 2, 4, and 7).

The diffuse, opaque, yellowish areas corresponded to similar, perhaps slightly thicker, diffuse cuticular deposits, over

which the epithelium had lost its pigment content, so that the color of the underlying plaques became more evident (fig. 3). The yellow lesions appeared to be the oldest and resulted from the slowly progressive degeneration of the pigment epithelium over the extensive cuticular plaques.

The degeneration of the pigment epithelium is at first limited to isolated groups of its cells and this fact, demonstrable in the sections, may well be responsible for the light-colored dots, which appear within the gray areas and which have the color of drusen, but very unlike drusen, have a moth-eaten outline (figs. 2 and 8). In an advanced stage of this degeneration, a few remaining pigment-bearing cells would be visible as dark spots on a yellowish background (fig. 3).

Conclusions

The pathogenesis of angioid streaks is based upon an abnormal fragility and opacification of the lamina basalis of the choroid. The natural variations of the intraocular pressure by muscular action or slight pressure upon the eyeball may, in such eyes, cause breaks in the membrane, the margins of which are clinically visible because the membrane has lost its translucency.

In all anatomic studies so far, the basis for this fragility and opacification of Bruch's membrane has been revealed to be primarily a degeneration of its elastic portion, corresponding to a general inferiority of the elastic tissue of the body, as the frequent association with pseudoxanthoma elasticum of the skin and with severe, degenerative vascular disease indicates. Theoretically, however, deposits in the membrane of any kind, such as calcium, iron, or magnesium salts following a disturbance of tissue metabolism with or without coexisting constitutional disease, could also deprive the membrane of its transparency and elasticity. In angioid streaks associated with osteitis deformans, for instance, the sequence of events may be slightly different from that in the eyes studied histologically up to the present time. Deposition of calcium salts into a normal lamina basalis, similar to calcification of other healthy tissues in patients with Paget's disease, could also render the membrane fragile and opaque without preceding elastic degeneration. These considerations lead one to speculate about the possible varieties and types of pathologic processes which may affect the lamina basalis in the course of local or constitutional disease.

The clinical picture of angioid streaks represents not only the visible ruptures in Bruch's membrane, but also the multiform end results of irritation of pigment epithelium and choriocapillaris by the sharp, calcified edges and fragments of the broken membrane. Calcification, therefore, even if secondary to the elastic degeneration in the pathologic process, is essential in production of all except, perhaps, the earliest manifestations of the disease.

7427 South Shore Drive (49).

References

[1] Plange, O. Ueber streifenförmige Pigmentbildung mit secundären Verändermgen der Netzhaut infolge von Hämorrhagien. Arch. f. Augenh. 1891, v. 23, p. 78.
[2] Knapp, H. On the formation of dark angioid streaks as an unusual metamorphosis of retinal hemorrhage. Arch. of Ophth., 1892, v. 21, p. 289.
[3] Boeck, J. Zur Klinik u. Anatomie der gefässähnlichen Streifen im Augenhintergrund. Zeitsch. f. Augenh., 1938, v. 95, p. 1.
[4] Hagedoorn, A. Angioid streaks. Arch. of Ophth., 1939, v. 21, p. 746.
[5] Klien, B. Discussion of Dr. E. V. L. Brown's paper on retroretinal tissue from the choroid in Kuhnt-Junius disciform macular degeneration. Amer. Jour. Ophth., 1941, v. 25, p. 990.

[6] Groenblad, E. Angioid streaks. Arch. of Ophth., 1939, v. 21, p. 746.
[7] Hallopeau and Laffitte. Nouvelle note sur un cas de pseudoxanthome elastique. Annales de Derm. et Syphil., 1903, v. 4, p. 595.
[8] Nomland, R., and Klien, B. Pseudoxanthoma elasticum of skin. Arch. of Derm. & Syph., 1933, v. 27, p. 894.
[9] Finnerud, C. W. and Nomland, R. Pseudoxanthoma elasticum, proof of calcification of elastic tissue. Arch. Dermat. & Syph., 1937, v. 35, 653.
[10] Terry, T. L. Angioid streaks and osteitis deformans. Trans. Amer. Ophth. Soc., 1934, v. 32, p. 555.
[11] Lambert, R. K. Paget's disease with angioid streaks of retina. Arch. of Ophth., 1939, v. 22, p. 106.
[12] Morrison, W. H. Osteitis deformans with angioid streaks. Arch. of Ophth., 1941, v. 26, p. 79.
[13] Wells, H. G., and Holley, S. W. Metastatic calcification in osteitis deformans. Arch. of Path., 1942, v. 34, p. 435.
[14] Seligman, B., and Nathanson, L. Metastatic calcification in soft tissues of legs in osteitis deformans. An. Int. Med., 1945, v. 23, p. 82.

SURGICAL TECHNIQUE OF CORNEAL TRANSPLANTATION IN RABBITS*

A DISCUSSION OF THE PROBLEMS ENCOUNTERED AND SUGGESTIONS FOR THEIR SOLUTION

FREDERICK C. STANSBURY, M.D., AND JOSEPH A. C. WADSWORTH, M.D.
New York

The difficulty with which corneal transplantation is successfully accomplished is such that it is seldom attempted on human subjects until the surgeon has acquired some skill with the procedure on experimental animals. The laboratory animal best adapted to this operation, from the point of view of both expense and availability, is the rabbit. All of the pioneers in this new field of ophthalmic surgery (Castroviejo, 1931, etc.; Filatov, 1935, etc.; Thomas, 1930, etc.) have experimented at length on rabbits before proceeding to human patients. These men have written about the different types of operation practised by them individually on human beings, but no one has given a detailed account of the surgical technique employed in keratoplasty on the rabbit. The purpose of this paper is, therefore, to describe in detail the procedure of keratoplasty on rabbits, and the difficulties encountered in this operation, following in general the technique employed by Castroviejo.

* From the Institute of Ophthalmology of the Presbyterian Hospital, New York City.

TECHNIQUE OF TRANSPLANTATION

PROBLEMS ENCOUNTERED

There are problems in transplantation of the rabbit's cornea that are not encountered in the same operation on the human cornea. The rabbit's cornea is thinner than that of man, and this fact makes the placing of the suture, the apposition of the cut surfaces, and the prevention of postoperative bulging more difficult. Anesthesia is a trying procedure and some animals may die on the operating table. It is not feasible to bandage the rabbit's eye, and one must resort to lid sutures—an unsatisfactory method, to say the least, when a pressure bandage is desired. Infection is difficult to prevent in any laboratory animal, and the rabbit is no exception. The postoperative bedrest and immobility, which are prescribed

for the human patient after keratoplasty, are quite obviously out of the question for the rabbit. Once the surgeon is able to overcome these operative difficulties peculiar to the rabbit and is able to perfect his surgical procedure on this animal, he is better prepared to operate upon the human being.

This paper will discuss the operation of square, partial penetrating keratoplasty, and will give an account of the equipment needed, the preparation of the rabbit, the surgical procedure, as well as the management of the difficulties encountered.

Equipment required for the operation

A narrow operating table, not over 12 inches in width and about 4 feet long, will be found very practicable for rabbit surgery. The height can be varied according to the standing or sitting position of the operator. The narrow table is desirable in order that both operator and assistant may be able easily and comfortably to reach the operative field. Any one of the common small instrument tables is satisfactory for the instruments. A good operating lamp of the hammer type provides satisfactory illumination. Other needed items—scrub sink, sterilizer, and so forth—will be found in any well-equipped animal operating room.

The following instruments (fig. 1) are necessary: (1) Castroviejo double-bladed knife, for marking the limits of the window in the recipient's eye and the limits of the graft in the donor eye. (2) Castroviejo's special keratome, 4-mm. wide, for making the initial incision into the anterior chamber in both the recipient and the donor eyes. (3) Modified de Wecker scissors, for cutting the remainder of the incision in both eyes. (4) Spatula, for lifting the graft from the donor eye and placing it in the recipient eye, and also for last-minute manipulations of the graft when tightening and tying the suture. (5) Fine needle holder, for placing the sutures and tying. (6) Elschnig's fixation forceps, for grasping the episclera and fixing the eye. (7) Fixation forceps, for holding the lids when they are sutured together. (8) Scissors, for cutting the sutures. (9) Mosquito clamp, for holding the moss suture in the center of the window being cut out of the recipient's cornea. (10) Small, straight, toothless forceps for tightening suture. (11) Small, curved, toothless forceps, for tightening the suture. (Oftentimes either the straight or curved forceps will also be used for tying the suture.) (12) Speculum, for separation of the lids. (13) 7-0 double-armed black silk suture with atraumatic needles.

The following solutions and ointments are recommended: (1) 3-percent atropine-sulfate solution. (2) Sodium-pentobarbital solution (45 mgm. per cc. of 10-percent alcohol solution). (3) 4-percent cocaine solution. (4) 20-percent argyrol solution. (5) Sterile physiologic saline solution. (6) 2-percent fluorescein solution. (7) 1-percent sodium citrate solution. (8) Adrenalin solution (1:1,000). (9) Penicillin ophthalmic ointment. (10) 1-percent atropine-sulfate ointment.

Preparation of the rabbit

In selecting rabbits for keratoplasty, it is well to obtain an animal weighing five pounds or more. Smaller rabbits may be used, but the operation becomes more difficult on the smaller eye. The rabbits should be obtained sufficiently far in advance of the operation so that they may occupy their new quarters for at least 10 days prior to surgery. A small percentage of rabbits will die when removed to the small cages that constitute their quarters in the medical school or hospital. Further, it has been found that new rabbits do not

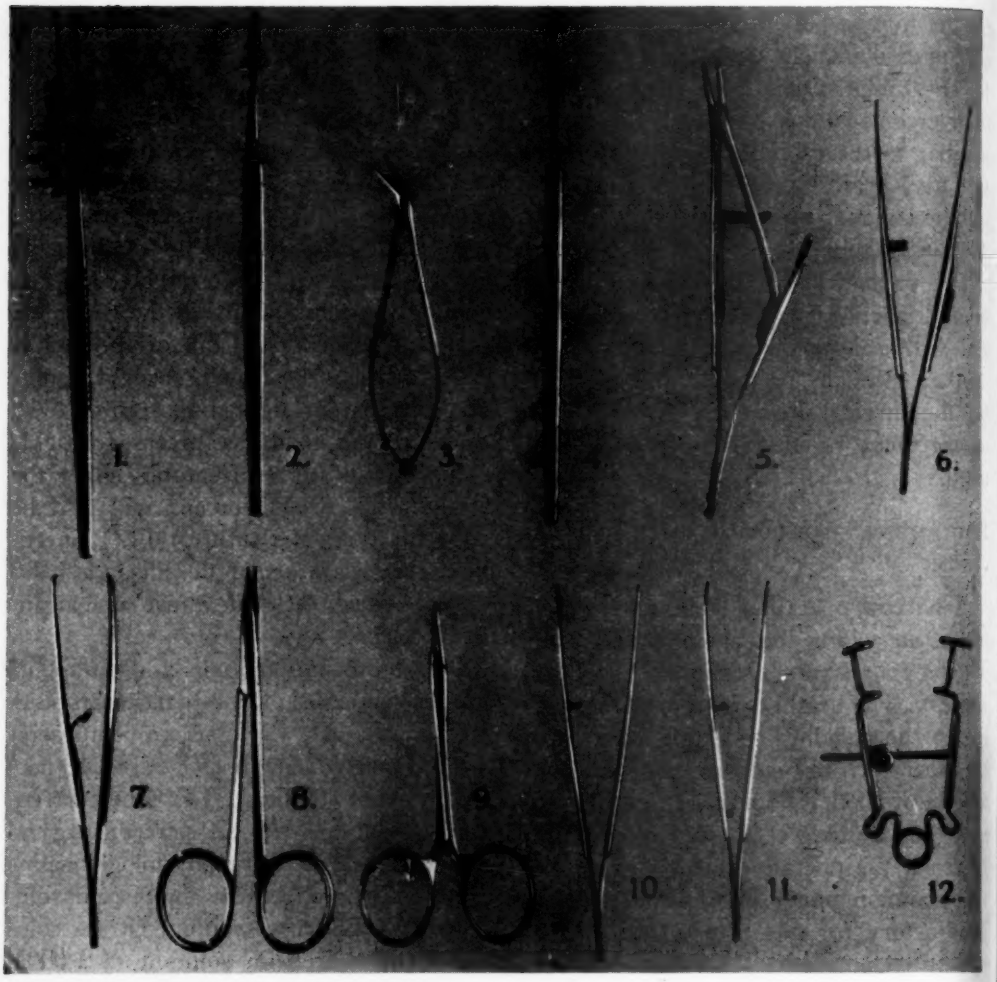


Fig. 1. (Stansbury and Wadsworth). Recommended instruments: (1) Castroviejo double-bladed corneal knife; (2) Castroviejo special keratome; (3) modified de Wecker scissors; (4) spatula; (5) needle holder; (6) Elschnig's fixation forceps; (7) fixation forceps; (8) scissors; (9) mosquito clamp; (10) small straight toothless forceps; (11) small, curved, toothless forceps; (12) speculum.

do well postoperatively. On the other hand, rabbits that are well acclimated to their lot will usually take the anesthesia and operation uneventfully.

Six hours prior to the operation, the rabbit is brought to the animal operating rooms, and atropinization of the designated eye is started. A drop of 3-percent atropine-sulfate solution is instilled into this eye each hour for six doses.

Sodium pentobarbital, intravenously, is used for the anesthesia. A solution is made of 45 mgm. of sodium pentobarbital per cc. of 10-percent alcohol solution, and 1 cc. of the resulting solution is given for each kilogram of body weight. Three fourths of the estimated dosage is slowly injected intravenously 1½ hours before operation, and the remainder of the calculated amount is given one-half hour before operation. This will usually be sufficient, but sometimes it is necessary to introduce a very small additional amount just before fastening the animal into the clamp.

After the second injection of sodium

pentobarbital, the rabbit will lie quiet and submit to the trimming of the hair around the operative field. The hair is removed from an area at least one centimeter wide around the eye. In addition, all the long whiskers on that side of his head are cut. At this time, a drop of 4-percent cocaine solution is instilled into the conjunctival sac.

The rabbit is then placed on the operating table and fastened into the special clamp (fig. 2). The head is adjusted to fit snugly into the clamp, and the screw is turned down. The animal is further immobilized by lashing the extremities to the table (fig. 3). Twenty-percent argyrol solution is then instilled into the conjunctival sac, washed out with sterile saline, and another drop of 4-percent cocaine solution is instilled. A small sterile sheet, with a diamond-shaped opening for the eye, is then placed over the rabbit and fastened with two towel clamps.

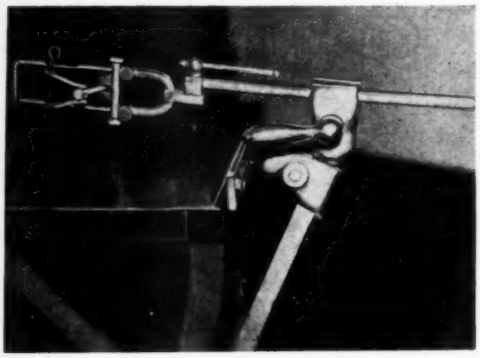


Fig. 2 (Stansbury and Wadsworth). Clamp for immobilization of the rabbit.

Surgical procedure

Separation of the lids is obtained by means of the standard eye speculum. Care must be taken when inserting the speculum to be sure the nictitating membrane of the rabbit is caught behind one arm of the speculum. The eyeball is then fixated with Elschnig's forceps, and the area to be removed is marked out with the double-bladed Castroviejo knife. The blades of this knife have previously been treated with 2-percent fluorescein solution, so that the knife cuts and stains the cornea at the same time. Using a 7-0 double-armed silk corneal suture with atraumatic needles, the continuous corneal suture of Castroviejo is then inserted, placing all the bites 1 mm. from the fluorescein-stained incision (fig. 4).

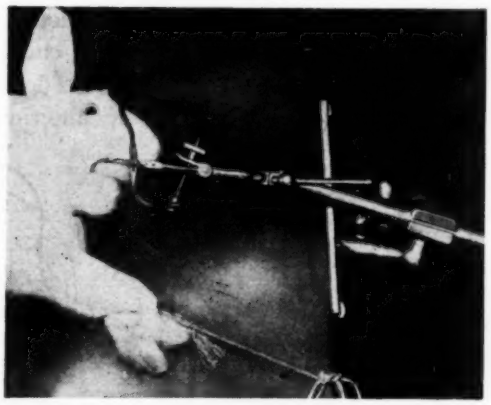


Fig. 3 (Stansbury and Wadsworth). Immobilization clamp with the rabbit in position.

It is our practice to begin the first bite at the 9-o'clock position and to come out at the lower left-hand corner of the square; to begin the second bite at the upper right-hand corner of the square and to come out at the 12-o'clock position; to begin the third bite at the 6-o'clock position and to come out at the lower right-hand corner; to begin the fourth bite at the upper left-hand corner and to come out at the 9-o'clock position. The last bite begins at about the 3-o'clock position and comes out about 3 mm. from the limbus. As each bite is placed, the loop of suture so formed is placed beyond the upper left corner of the square. Each succeeding loop is placed on top of the preceding one. One end of the suture is then cut off, and a bite is placed in the middle of the square. The two ends of this last suture are then fastened in a mosquito clamp.

A keratome incision is then made in the lower right-hand corner of the square, beveling it in the manner described by Castroviejo and Thomas. Care must be exercised in this maneuver to avoid injuring the lens. By making this incision in the corner of the square, only one cut is left on that leg of the square to be done with scissors. As soon as the anterior chamber is opened, the assistant begins instilling 1-percent sodium-citrate solution into the conjunctival sac (to avoid formation of fibrin). While the square is lifted a slight distance above the lens with the mosquito clamp attached to the Moss suture, the lower blade of the de Wecker scissors, tilted in the same manner as was the keratome, is then passed through the keratome incision and the remainder of the lower leg of the square is completed. The scissors are turned and the left hand side of the square is cut. The scissors are then brought down to the lower right-hand corner of the window, and the right-hand side is completed in the same manner. Finally, the upper end is finished in the same manner. While the assistant continuously drops citrate solution over the operative field, a similar graft is excised from the donor eye, using the same procedure, except that no Moss suture is used, and the instruments are not tilted when cutting.

The graft is then picked up with the spatula and gently placed in the window in the recipient's cornea. Any rolling of the edges or corners is corrected with the spatula. Then the suture is tightened, using the small straight and the small curved utility forceps. We begin to tighten with the last suture inserted and work backwards to the first one (fig. 5). When all the sutures are snug, and the graft is in good position, a surgeon's knot is tied at the 3-o'clock position, near the limbus. The instillation of the citrate solution is then stopped, and a drop of 3-percent atropine solution is instilled. At this point, we inject a small amount of adrenalin solution (1:1,000) subconjunc-

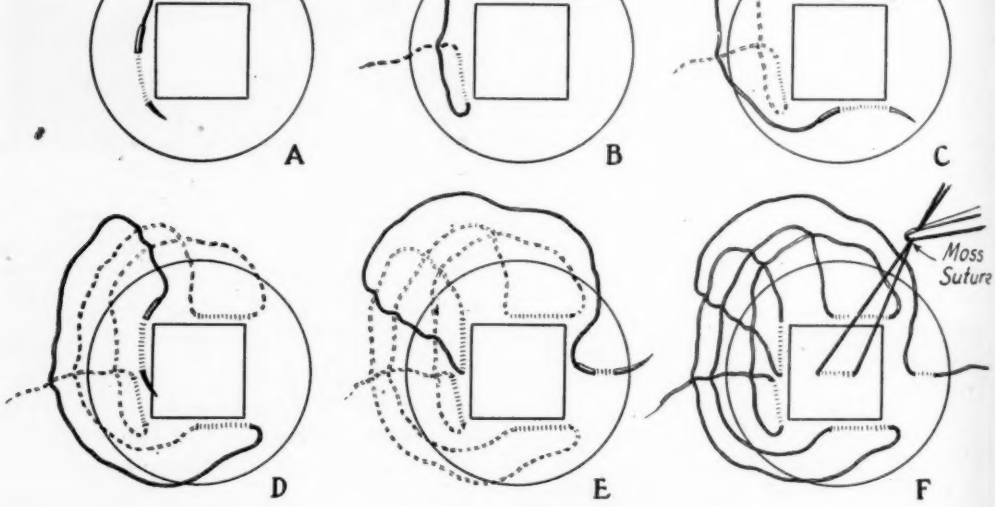


Fig. 4 (Stansbury and Wadsworth). Steps in placing the suture in the cornea, with arrangement of the loops.

tivally. Three through-and-through lid sutures are then put in position—one in the center of the lids, and one 3 to 4 mm. to each side. Before the last suture is tied, penicillin ophthalmic ointment is injected into the conjunctival sac.

When the rabbit is taken back to his quarters, a meshed-wire floor is placed in his cage instead of straw. Every other day, postoperatively, 1-percent atropine ointment and penicillin ophthalmic ointment are instilled into the conjunctival sac. One week after operation, the animal is again given the sodium-pentobarbital anesthesia, and the sutures are removed. If anterior synechiae are present, they are broken up with adrenalin subconjunctivally, or neosynephrin or atropine in the conjunctival sac. If infection is present, penicillin is used as long as necessary. It is desirable to keep the rabbit 6 to 8 months postoperatively to determine whether or not the graft will remain transparent.

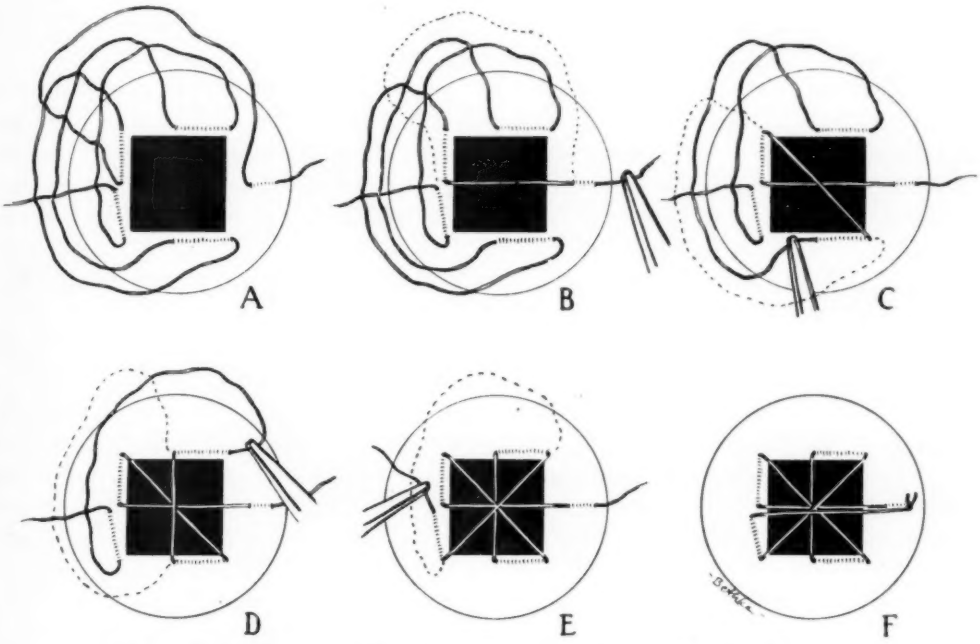


Fig. 5 (Stansbury and Wadsworth). Final steps in completion of the suture.

Discussion

Anesthesia

Probably no one factor has given us more concern than the administration of the anesthesia. The first system tried was to calculate the amount of pentobarbital to be given and to make a slow intravenous injection of this amount. Many rabbits will go into respiratory failure within 15 minutes if this is done. Once administered, there is practically nothing the operator can do to lighten the effects of the anesthetic. Nonvolatility is one of the characteristics of the barbiturates that makes for a prolonged and continuous anesthesia. This same nonvolatility precludes their excretion through the lungs, and so the concentration depends solely on the dosage. Once too much is given, we have been unable to resuscitate the rabbit. Since this was the case, we tried to weigh the rabbit more carefully and to calculate the dosage more accurately. The

response to pentobarbital is quite variable in different rabbits, however, as it is in human beings. Large rabbits may die with less than the calculated dosage, and small ones may require double the estimated amount.

The attempt was made to give the anesthetic intraperitoneally, but here the absorption was very slow and irregular. Large amounts are required for deep anesthesia, and the large number of doses and the amount of time required to watch the animals precluded this method. A weaker solution of sodium pentobarbital was tried, but this was not found to be satisfactory.

Finally, fractionalization of the anesthesia was worked out, and this system has proved satisfactory. Three fourths of the estimated dosage is slowly given in an ear vein 1½ hours before operation. One hour later, if the rabbit is not too sluggish, the rest of the dose is given. Just before fastening the animal in the clamp, additional pentobarbital is given as needed. This method of fractionalization of the administration of the anesthesia has resulted in no deaths.

Separation of the lids

Wide separation of the eyelids, without the interference of cumbersome instruments, is necessary during the operation: (1) to provide an operative field, and (2) to prevent pressure on the globe. In the rabbit we have tried three methods of holding the lids apart: (1) the conventional speculum, (2) sutures through the lids, and (3) Castroviejo mosquito lid-clamps.

Advantages of the speculum are ease and quickness of insertion and elimination of trauma to the lids. Some workers (Castroviejo, 1941,) believe that it interferes to some slight degree with instrumentation in the operative area, especially during use of the double-bladed knife, and that it does not provide as large an exposure as the other two methods.

Lid sutures provide a satisfactory operative field and are particularly efficacious in immobilizing the nictitating membrane. However, their disadvantages are considerable. They are painful and often arouse the rabbit. They may cause hematomas of the lids. They often result in bleeding, and blood in the conjunctival sac, postoperatively, is undesirable because it forms an excellent medium for bacterial growth.

Castroviejo's lid clamps also provide a good field and do not have the disadvantages of the lid sutures. Nevertheless, the small drape used in rabbit surgery does not constitute a good anchor. Lid sutures and lid clamp may produce too much traction and may cause tenting of the lids, which will result in poor exposure.

After trying the second and third methods on a number of rabbits, the first method—the use of the lid speculum—was adopted as the least traumatic and the most facile procedure. It is comparatively easy to avoid touching the speculum with any of the cutting instruments simply by rotating the globe with the fixation forceps until the cornea is in the desired position. Katzin (1946) advocated complete immobilization of the globe by radial sutures in the limbus. This type of immobilization, in our opinion, is unsatisfactory, not only because its use may endanger the eye but also because it may compel the surgeon to work from awkward angles.

Marking the cornea

Correct marking of the cornea can be a great help in facilitating a successful transplant. If it is incorrectly done, however, the remainder of the procedure may be hindered by numerous unnecessary difficulties. The blades of the Castroviejo knife must be parallel and set firmly at the desired width (5 mm. for rabbits).

If the blades are not parallel, the resulting wide, ragged line will make it difficult to maintain a perfect square when the window is removed with the scissors.

The knife must be gently placed on the cornea in such a manner as to exert equal pressure on both blades; otherwise uneven lines will be made. Pressure should be sufficient to penetrate the epithelium only. If the marking is too deep, the lines tend to gape and the staining becomes diffuse. Care must be taken not to carry the lines too far along the cornea and cause unnecessary damage to the recipient epithelium. The second marking must be perpendicular to the first, or a square window will not result.

It has been our experience, as well as that of other workers (Carpenter and Smyth, 1946), that fluorescein on a rabbit's cornea will stain the entire cornea in a short time. However, we found that, by applying fluorescein to the knife and allowing it to dry before marking the cornea, the treated knife made very fine lines, which had less tendency to diffuse.

In marking the donor eye, it is advisable to hold the eye gently in order not to stretch the globe; otherwise, the transplant may be too small for the prepared area. In addition, if the eye is held too firmly, the lens will be pushed forward and its capsule will be ruptured while the transplant is being removed. Although this is not any great mishap, it adds to the difficulty of accurately cutting and removing the prepared square.

Placing the suture

It is essential to the success of a keratoplasty that the suture holding the graft in place be located with exact precision. The suture in the corneal stroma should be approximately 1 mm. from the incision. If it is placed closer than 1 mm., it is difficult to cut the window without severing the suture. If it is placed farther than 1 mm., it will tend to buckle the approximated edges of the cornea and the graft when the suture is tightened at the end of the operation. Furthermore, it is very important that the suture be placed so that the arms of the suture, as they crisscross over the graft, cross exactly over each corner, because these are favorite locations for bulging. That means that the suture must enter the cornea precisely opposite the apex of the right angle that forms each corner of the window. It was for this reason that Thomas gave up square transplants in favor of the circular form (Thomas, 1930).

The cornea puts up considerable resistance to the passage of the needle through its substantia propria. If the operator pulls away from the fixation forceps, the conjunctiva will not withstand the traction exerted in placing the suture but will give way at the limbus. However, if the fixation forceps are applied in such a manner that the force of the needle pushes toward the forceps, this accident will not occur.

What to do with the loops of suture while the operation is being finished is another one of the problems encountered. In order to avoid a snarl of the loops at the time when one wants to tie quickly and close the wound, it was found necessary to place the loops to one side in a definite pattern. We now lay all the loops of the suture to the upper left side, in the following manner. The first loop, which may be called the 7-to-1 loop, using the numbers as they appear on the face of the clock, is placed to the upper left, over the free end of the suture coming out at the 9-o'clock position. The second loop, called the 12-to-6 loop, is placed above the 7-to-1 loop. Likewise the third loop, the 5-to-11 loop, is placed above the 12-to-6 loop, and finally the 9-to-3 loop is placed above the other three. The free end extends off to the right (fig. 4).

Some operators place the entire suture, tighten the loops ready to tie, and then loosen the loops again, presumably to be sure the loops are located properly. This has been found unnecessary, provided the systematic steps outlined above are followed.

What should be done if a leg of the suture is cut during the operation? We have found that the corneal canals are very easy to relocate and that the needles will pass through the canals without friction; so the cut suture is pulled out and a new one inserted. If one goes too deep with the needle and perforates into the anterior chamber, the needle should be removed and a new canal made. This step is necessary to avoid formation of a fistula.

Problem of fibrin

The presence of fibrinogen in the normal aqueous of the rabbit results in the formation of fibrin as soon as the anterior chamber is opened, and may be a great bother in the completion of a keratoplasty. It has been our experience, as well as that of others (Thomas, 1934), that a solution of sodium citrate in normal saline will obviate the formation of fibrin.

Just as soon as the anterior chamber is opened, a continuous drip of 1-percent sodium citrate in saline should begin and be continued until the suture has been tightened and tied. If such a system is not maintained, troublesome collections of fibrin will accumulate within the window of the cornea and will render the placement of the graft more difficult. The loops of the suture must also be bathed in the citrate, or the firm snarling of the loops will endanger proper placement and lessen the chances for a satisfactory transplant. Not infrequently the coagulation may be so severe and firm that it is almost impossible to separate the sutures from one another. The removal of the fibrin is so tedious and traumatic that the graft may be poorly placed. Soaking of the suture material in citrate before the sutures are placed in the cornea will help to maintain their pliability and softness.

Tying the suture

The mere matter of tightening the loops and tying the suture would appear very simple, but such is not always the case. If the loops are not kept in some pattern so that the operator can identify them, he will find a snarl of silk before him. However, if they are arranged as has been described, the tying can be expedited.

We use the two small forceps, one for lifting up the loop and the other for pulling it through the cornea. First we lift up the 9-to-3 loop and pull it through loosely (fig. 5), pulling on the free end of the suture near the limbus at the 3-o'clock position. Next the 5-to-11 loop is lifted up and pulled through at the 6-o'clock position. Then we lift up the 12-to-6 loop and pull it through at the 1-o'clock position. Finally, the 7-to-1 loop is lifted up and pulled through at the 9-o'clock position. The apposition of the graft is then checked all around the periphery, using the spatula for any necessary adjustments.

With the same two forceps, this procedure is now repeated and all the loops are given a final tightening. They are pulled as tight as can be done without dimpling or buckling the cornea at any place, either on the graft or on the recipient's own cornea. This is very important, because the suture controls the apposition of the cut surfaces and, if snug enough, prevents bulging. The suture is tied near the limbus, first with a surgeon's knot to hold the wet suture material and then with a conventional tie. Finally, the spatula may be inserted between the

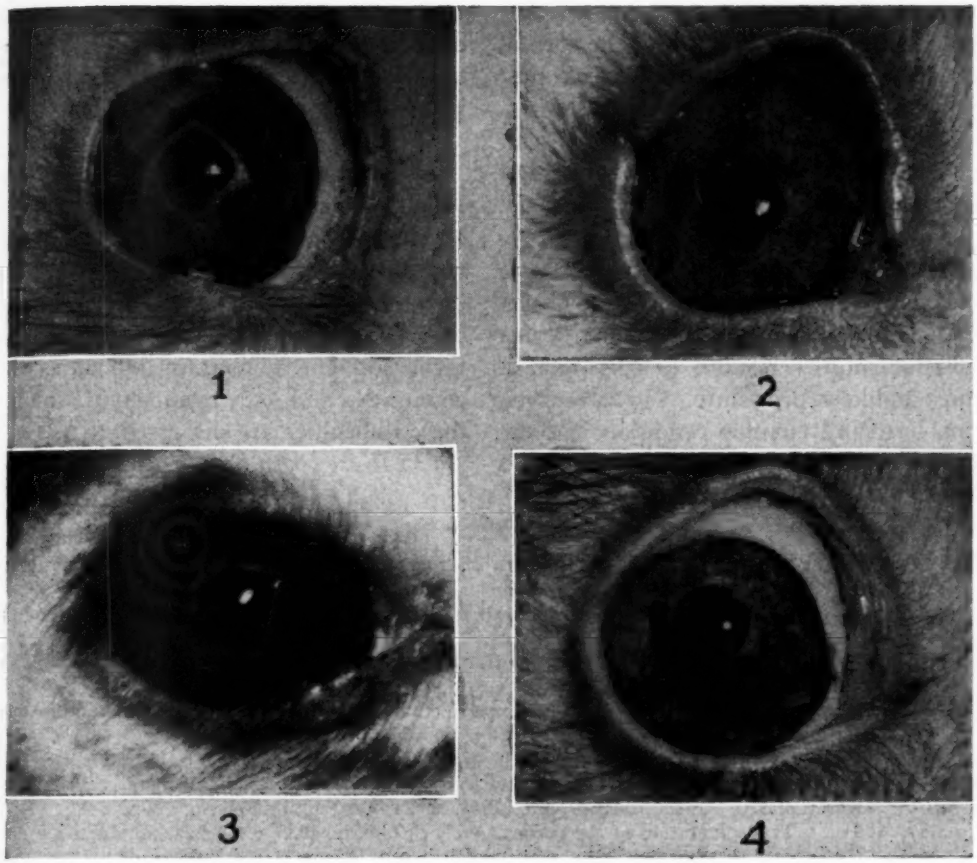


Fig. 6. (Stansbury and Wadsworth). Pictures of rabbits after transplantation. (1), (2), and (3) show successful results. (4) is a postoperative ectasia.

center of the graft and the crossing loops of the suture and gently lifted once or twice, to give a last general distribution of the tension of the suture.

Lid closure

Simple through-and-through fine black silk sutures, placed at equal intervals through the lid margins, give a very satisfactory closure of the lids. Numerous other methods were tried in an endeavor to obtain pressure, but various disadvantages precluded their adoption. Two mattress sutures were tried, but they were more traumatic and several troublesome postoperative infections resulted. Moreover, they frequently pulled through, probably the result of the rabbit's efforts to remove the uncomfortable sutures. In an effort to maintain pressure, a wide overlapping of the lids with mattress sutures was tried, but the resulting irritation and secondary infection made this method impracticable.

Postoperative ectasia

One of the difficulties we have not been able to overcome is the postoperative bulging of the central portion of the cornea, including the graft. Often, when we remove the sutures on the 7th or 8th day, we find the graft in good position, the anterior chamber reformed, no synechiae and no infection, only to be followed a

day or two later by very considerable bulging of the whole center of the cornea, with the graft at the apex of the conus. Some of these cases have progressed satisfactorily to complete healing of the scar, and the graft has remained in place and transparent for over six months (fig. 6). We attribute this type of unsuccessful result to our inability to apply a pressure bandage to the rabbit's eye. These observations make fibrin fixation of the cornea without suture (Katzin, 1946) appear a most unlikely procedure. We have been unable to prevent this condition in some rabbits, although we now remove the lid sutures one week after operation and the corneal suture about 10 days postoperatively. We have not employed this system long enough to determine its efficacy.

Conclusion

A satisfactory method of keratoplasty on rabbits, following in general the technique of Castroviejo, is described. A list of the necessary equipment and a detailed description of the procedure followed are recorded. The numerous difficulties encountered, and our methods of solving these difficulties are discussed.

635 West 165th Street (32).

References

Bellows, J. G. Influence of local antiseptics on regeneration of corneal epithelium in rabbits. Arch. of Ophth., 1946, v. 36, July, p. 70.

Carpenter, C. P., and Smyth, H. F. Chemical burns of the rabbit cornea. Amer. Jour. Ophth., 1946, v. 29, Nov., p. 1363.

Castroviejo, R. New Method of corneal transplantation: Final report. Proc. Staff. Meet. Mayo Clinic, 1931, v. 6, Nov. 11, p. 669.

———. Keratoplasty: An historical and experimental study, including a new method. Amer. Jour. Ophth., 1932, v. 15, Sept., p. 825; Oct., p. 905.

———. Present status of keratoplasty. Arch. of Ophth., 1939, v. 22, July, p. 114.

———. Mosquito lid-clamp retractors. Amer. Jour. Ophth., 1939, v. 22, p. 1018.

———. Keratoplasty. Amer. Jour. Ophth., 1941, v. 24, Jan., p. 1; Feb., p. 139.

Filatov, V. P. Transplantation of the cornea. Arch. of Ophth., 1935, v. 13, Mar., p. 321.

———. Experimental transplantation of the dried and frozen corneas. Vestnik. oftal., 1940, v. 17, p. 536.

———. Transplantation of the cornea. Amer. Rev. Sov. Med., 1944, v. 2, Dec., p. 159.

Katzin, H. M. Aqueous fibrin fixation of corneal transplants in the rabbit. Arch. of Ophth., 1946, v. 35, Apr., p. 415.

———. Animal operating equipment for experimental ocular surgery. Arch. of Ophth., 1946, v. 36, Aug., p. 215.

Sollmann, T. A Manual of Pharmacology and Its Application to Therapeutics and Toxicology. Philadelphia, W. B. Saunders Co., 1937.

Thomas, W. T. Transplantation of the cornea: A preliminary report on a series of experiments in rabbits, together with a demonstration of four rabbits with clear corneal grafts. Trans. Ophth. Soc. United Kingdom, 1930, v. 50, p. 127.

———. Successful grafting of the cornea in rabbits. Lancet, 1931, v. 1, Feb. 14, p. 335.

———. Return of sensitivity in grafts in rabbits. Proc. Roy. Soc. Lond., 1931, v. 108, June, 1, p. 301.

———. Transplantation of scleral tissue on to a rabbit's cornea. Trans. Ophth. Soc. United Kingdom, 1932, v. 52, p. 64.

———. Experimental grafts of devitalized corneal tissue. Trans. Ophth. Soc. United Kingdom, 1934, v. 54, p. 119.

———. Experimental heterogenous corneal grafts. Trans. Ophth. Soc. United Kingdom, 1936, v. 56, p. 97.

THE SUBSTITUTION OF CEREBROSPINAL FLUID FOR VITREOUS CLOUDED WITH OPACITIES*

MILO H. FRITZ, M.D.
New York

HISTORICAL REVIEW

"Among the most unsatisfactory cases as regards treatment and prognosis that seek advice at our various hospitals, those in which impaired vision or lost vision is due to opacities of the vitreous form a considerable number. Unless such can be traced to specific diseases, treatment is practically useless." This was said by Ford[1] 57 years ago, and the statements are as nearly true today as when they were written. Ford attempted with considerable success to clear vitreous opacities in human eyes by withdrawing 10 to 18 minims at intervals of from 2 to 3 days.

In the years intervening between 1890 and 1947, many investigators have repeated the work of Ford, although some of them had no knowledge of his work. The subject was well reviewed by zur Nedden,[2] in 1928 and N. L. Cutler,[3] in 1937.

The first worker actually to attempt the substitution of a clear medium for vitreous clouded with opacities in human eyes was Gradenigo,[4] who, in order to avoid loss of intraocular pressure, devised a double syringe of such construction that it delivered to a closed space containing fluid the same amount of fluid that it withdrew, thus leaving the fluid pressure unchanged. To this syringe were fixed two rubber tubes of fine caliber, leading to two sharp needles both of which were inserted into the vitreous chamber at the equator of the eye, one between the medial and superior recti, and the other between the lateral and superior recti. In this manner, Gradenigo replaced cloudy vitreous with normal saline solution or vitreous from freshly killed animals without reduction of intraocular pressure. No clinical studies on diagnosis, amount of vitreous replaced, vision, or intraocular pressure were included in this paper.

In 1906, Deutschmann[5] reported 67 human cases of retinal detachment treated by repeated injections of very small amounts of vitreous from calves' and rabbits' eyes. Even though the primary aim of this work was to reattach detached retinas, it is quoted as one of the earliest attempts in ophthalmology to inject foreign substances into the vitreous. Three of the cases were cured, 26 were improved, and 38 were unimproved. Deutschmann mentioned that vitreous abscess was a rare complication of this procedure.

Komoto, [6] in 1910, reported two cases in which "good vision" was restored after the eyes had been blind for a long time following retinal hemorrhages into the vitreous. He made a scleral incision and irrigated the vitreous chamber with normal saline solution, presumably leaving a sufficient amount of saline to approximate normal intraocular volume.

Fifteen human cases of vitreous opacities caused by hemorrhages, iridocyclitis, hemophthalmos, suppurative infiltration of the vitreous, and opacities associated with detached retina treated by injection of normal saline solution were reported by Elschnig,[7] in 1911. Vitreous (0.4 to 0.8 cc.) was withdrawn, and an equal amount of normal saline solution was substituted. All of the eyes had been blind for years. Best results were obtained in

* The expenses connected with this research were met by the Florence Ellsworth Wilson Memorial Fund Fellowship in Ophthalmology of The Eye-Bank for Sight Restoration, Inc., New York.

the cases of hemorrhage into the vitreous. Iritis and a small hypopyon complicated the recovery of one case. Poorest results were obtained in cases of opacities following iridocyclitis. Fair results were obtained in the other cases. Exact studies of vision and intraocular pressure were not made. One or two injections were made at intervals of 3 to 10 days.

In 1912, Dor[8] reported two cases in which cloudy vitreous due to hemorrhage were treated by Elschnig's technique of withdrawing less than 1 cc. of vitreous and substituting an equal amount of normal saline solution. Vision improved from light perception to 0.4 and 0.8 in these cases.

A most interesting third case, that of a soldier who was blind following spontaneous hemorrhages into the vitreous of both eyes, was courageously reported. Two needles were plunged into the vitreous chamber. Vitreous from a horse eye, enucleated 30 minutes before, was injected. Dor concludes: "This operation was not as simple as we had hoped. The needles from which we had hoped to see blood run became clogged and while injecting a little harder in the hope of clearing the second needle, we were able to produce only a painful hypertension of the eye. The result was absolutely nil. The patient returned two years later completely blind in both eyes, and we confess with regret that we had a pronounced hypotony in the eye we had hoped to cure while the other eye had a normal tension."

In 1929, C. A. Hegner[9] reported an experiment that attracted much less attention than it deserved. He reported replacing all the cloudy vitreous that he could withdraw from a living human eye without undue suction or other trauma with an equal amount of cerebrospinal fluid from the same patient. In the first case vision improved from light perception to 20/20 by substituting 1.5 cc. of spinal fluid. Four other cases were reported and all were similarly improved, although normal vision was not restored.

In 1946, Norman L. Cutler,[10] who had previously ascertained that rabbit vitreous could successfully be transplanted from one rabbit to another, reported three human cases in which he had substituted for 1.5 to 2 cc. of cloudy vitreous equal amounts of vitreous from donor eyes enucleated immediately beforehand in operating rooms under his control. In one case, vision was improved from light projection to 20/60−1, with a correcting lens, six months after operation. The second case was a failure as far as restoration of vision was concerned, but showed that the procedure could be done with impunity under these conditions. In the third case, that of a veteran with one eye, vision was improved from 20/300 to 20/20, with a correcting lens. In all cases the intraocular pressure remained normal.

In January, 1947, after considerable experimentation on refrigerated human eyes and live rabbit eyes, I had an opportunity to use cerebrospinal fluid to replace vitreous rendered cloudy with opacities due to hemorrhage. A search of the foreign and domestic literature resulted in the brief historic review herein presented and the discovery of Hegner's great experiment.

The reviews of Duke-Elder[11] and Redslob[12] revealed the tremendous amount of work that has gone into the explication of what is now known about the human vitreous, the great gaps in our knowledge of its composition, physiology, and properties, as well as the barriers in the way of further understanding.

Report of cases

The technique of the operation is still being perfected and will be described in

detail in a subsequent publication. Special needles and syringes are being developed through the kindness and generosity of Becton, Dickinson & Company of Rutherford, New Jersey.

The indications and contradictions for this operation are still to be determined fully. At the present time, any eye with a cloudy vitreous, not in an active state of uveitis, which has not improved under the usual conservative forms of treatment in a reasonable period of time, is considered suitable for this procedure. The patients or their parents were told of the experimental nature of the operation. All had a urinalysis, complete blood count, and a Wassermann test of the blood. Foci of infection were sought for and removed.

Case 1. S. G., a 13-year-old boy, was referred by Dr. David H. Webster as a possible candidate for replacement of a completely opaque vitreous by cerebrospinal fluid. The patient had been struck accidentally over the right eye through the closed lid in January, 1946. When the swelling of the contused lids had subsided sufficiently for them to be opened, it was found that the vision had been reduced to light projection from 20/20. A regime of topical applications to the eye, rest, hot compresses, and various subcutaneous injections of unknown medications failed to make any improvement in the vision in the 12 months following the accident.

Vision in the right eye was excellent light projection. There was no red reflex. Intraocular pressure was 21 mm. Hg (Schiøtz). The pupillary reaction was normal to light. Examination of the anterior segment under the slitlamp and corneal microscope was negative. The anterior vitreous was full of tiny red-gold opacities which had the appearance of hammered copper. Findings in the left eye were entirely negative, and the vision was 20/20.

On January 14, 1947, a spinal tap was done on the patient in bed. Cerebrospinal fluid (4 cc.) was withdrawn aseptically and carried to the operating room where it was transferred to the instrument tray.

Under pentothal anesthesia, the upper nasal quadrant of the right sclera was exposed through a conjunctival incision. A purse-string suture was placed at the puncture site about 12 mm. from the limbus. The special 18-gauge needle was plunged into the vitreous chamber and as much turbid vitreous as could be recovered by gentle suction and manipulation was withdrawn. This amounted to 1¼ cc. The globe collapsed as did the refrigerated human eyes upon which this operation had been done experimentally. Since no more vitreous could be recovered, approximately 1¼ cc. of the cerebrospinal fluid were injected. The needle point could immediately be seen clearly through the dilated pupil in the brightness of the overhead operating-room light. The purse-string suture was drawn up and tied as the needle was withdrawn and the conjunctival incision was closed. Examination with the ophthalmoscope at this point showed a clear channel in the hyaloid canal extending from the posterior lens capsule to the disc and macula, which could be seen with almost normal clarity. Dense opacities surrounded this clear channel. A 1-percent atropine-sulphate ointment and a dressing were applied to the right eye only.

The next day there was minimal conjunctival reaction and no pain or evidence of uveitis. The vision was 20/50−1, and the intraocular pressure to palpation through the closed lids appeared normal. The patient was allowed out of bed.

Three days later, the peripheral vitreous had begun to clear appreciably, tension was 19 mm. Hg (Schiøtz), and the vision was 20/40−1. On the fifth post-

operative day, the patient was permitted to go home.

Two weeks later, vision was 20/20 and the peripheral vitreous was clearer. The intraocular pressure felt normal through the closed lid, and there was no noticeable gross difference between the two eyes.

One month after the operation, vision was 20/20−1, the peripheral opacities had cleared still further, tension was 21 mm. Hg (Schiøtz), and the boy and his mother were tremendously pleased.

Case 2. I. D., a man, aged 58 years, was referred by Dr. R. Townley Paton as a patient who might be benefited by this procedure. The patient had an arrested case of pulmonary tuberculosis. Between 1941 and September, 1944, he had had 11 spontaneous retinal hemorrhages into the vitreous of the left eye with recovery of useful vision after each episode except the last, which had reduced the vision to light projection. He had received tuberculin injections for 16 months prior to this because it was felt that ocular tuberculosis might have been the cause of the hemorrhages.

Vision in the right eye was 20/20, with a +0.50D. cyl. ax. 110° and a +2.50D. sph. added for work at 16 inches. The media were clear and, except for a mild sclerosis of the arteries and arteriovenous compression, the fundus was normal. Intraocular pressure was 22 mm. Hg (Schiøtz).

Vision in the left eye was faulty light projection. Intraocular pressure was 19 mm. Hg (Schiøtz). Examination of the anterior segment by slitlamp and corneal microscope was negative. The pupillary reaction to light was normal. The red reflex was absent. The anterior vitreous was full of strands of gray opacities.

On January 20, 1947, under pentothal anesthesia, a procedure identical to that performed on Case 1 was done, except that 1½ cc. of cloudy vitreous were aspirated without undue suction or trauma. A similiar amount of cerebrospinal fluid was injected, but the point of the needle could not be seen, and at the conclusion of the operation, only the inferior temporal part of the vitreous seemed clearer.

A prompt recovery from the operation occurred, but the vision did not improve. The depths of the fundus could be seen dimly. Strands of proliferative retinitis and clumped choroidal pigment could be identified. Failure of vision to improve was attributed to retinal damage caused by repeated hemorrhages. For 48 hours after the operation, the patient saw a "round spot with a hole in it" at a point in his subjective visual field antipodal to the puncture site.

The patient left the hospital on the fifth postoperative day, and when seen four weeks later, had completely recovered from the operation. The visual acuity was unchanged, but the vitreous had cleared somewhat. Intraocular pressure was 16 mm. Hg (Schiøtz).

Case 3. J. C., aged 57 years, a housewife, was referred through the kindness of Dr. David H. Webster. She had had a spontaneous retinal hemorrhage into the vitreous at night, eight weeks before, and the upper half of the visual field was lost. The diagnosis lay between an inferior detachment and a neoplasm. Vision gradually deteriorated to light perception. Retinal detachment and retinal hemorrhage into the vitreous was the final diagnosis.

Vision in the right eye was light perception. The anterior segment was normal. The anterior vitreous was full of discrete, scintillating gold-brown particles. No red reflex could be obtained. The pupillary reaction to light was normal. Intraocular pressure was 11 mm. Hg (Schiøtz).

Vision in the left eye was 20/400, corrected to 20/20 with a +4.00D. sph.,

with a +2.75D. sph. added for work at 16 inches. The pupillary reaction to light was normal. The anterior segment was normal to examination by slitlamp and corneal microscope. The media were clear and the fundus was normal. Intraocular tension was 16 mm. Hg (Schiøtz).

On January 25, under pentothal anesthesia, 2 cc. of cloudy vitreous were withdrawn from the right eye and an equal amount of cerebrospinal fluid was replaced. No detail of the fundus of the eye could be seen immediately postoperatively, or from that time until the day of discharge, January 30, 1947. Vision was unimproved. Tension was 11 mm. Hg (Schiøtz) in the right eye, and 16 mm. Hg in the left eye.

The right eye was quite painful for three days after operation, and even though the withdrawn fluid was felt to be vitreous, it may well have been subretinal fluid.

Case 4. M. L., aged 58 years, was a private patient operated upon by Dr. Joseph Laval, who kindly gave permission for this case report. This patient had had a spontaneous hemorrhage into the vitreous of the right eye in June, 1942. Vision was gradually recovered until it approximated normal in June, 1946, when the patient was seen by Dr. Laval. At that time the systolic blood pressure on one reading was 168 mm. Hg. The retinal arterioles were moderately narrowed with an increased light reflex, and some arteriovenous compression. Terminal twigs at the maculas were tortuous.

In August, 1946, the patient returned to Dr. Laval because of a recurrence of the retinal hemorrhage into the vitreous of the right eye two weeks previously. Vision was reduced to light projection. Tension in both eyes was 20 mm. Hg (Schiøtz). Corrected vision in the left eye was 20/20. In the affected eye, the anterior segment was normal. The pupillary response to light was normal. The anterior vitreous was full of strings of reddish, granular opacities.

At operation, under local anesthesia, done in the inferior nasal quadrant, 1¾ cc. of stringy black vitreous fluid were aspirated, and fresh blood appeared in the syringe at the end of the aspiration. An equal amount of cerebrospinal fluid was injected, but the needle could not be seen in the vitreous chamber and the reflex appeared black on immediate postoperative examination. There was no improvement for the remaining five days of hospitalization. There was no change in tension. Recovery from the operation was uneventful. No cause for failure can be ascertained so soon after operation.

Summary and Conclusions

That the substitution of cerebrospinal fluid for cloudy vitreous is practical has been established. Four patients on whom this operation was performed are reported. The youngest patient, aged 13 years, whose vitreous hemorrhage followed trauma, presented the most remarkable case in that one year after an ocular contusion, vision was improved from light projection to 20/20−1. The three other patients, whose ages were in the late fifties and who had had spontaneous retinal hemorrhages into the vitreous, showed no improvement in vision following this procedure. From these experiments, admittedly inconclusive because of the short period of postoperative observation, it is felt that the sphere of usefulness of this operation can only be extended by the further work of many ophthalmologists. Many cases of partial or complete blindness, due to vitreous opacities, have drifted away from proper ophthalmic care because of the discouraging results of more conservative treatments.

210 East 64th Street (21).

References

[1] Ford. Proposed surgical treatment of the opaque vitreous. Lancet, 1890, v. 1, p. 462.
[2] zur Nedden. The curative value of aspiration of the vitreous. Arch of Ophth., 1928, v. 57, Mar., p. 109.
[3] Cutler, N. L. Thesis on transplantation of the vitreous in rabbits on file at Columbia University, College of Physicians and Surgeons Library, New York.
[4] Gradenigo, P. Annali di Ottal., 1902, v. 31, p. 650.
[5] Deutschmann, R. Zur operative Behandlung der Netzhautablosung. Klin. M. f. Augenh., 1906, v. 4, p. 364.
[6] Komoto. Ueber Glaskorperwaschung bei unheilbarer Glaskorperblutung. Abstracted, Klin. M. f. Augenh., 1912, v. 50, p. 265.
[7] Elschnig, A. Ueber Glaskorperersatz. Ber.u.d. Versamml. d. deutsch., ophth. Gesellsch., 1911, p. 514.
[8] Dor. Clinique Ophthl., 1912, v. 18, p. 118.
[9] Hegner C. A. Concerning the replacement of the vitreous humor. Ber. d. ophth. Gesellsch., 1929, v. 47, p. 391.
[10] Cutler, N. L. Transplantation of human vitreous. Arch. of Ophth., 1946, v. 35, June, p. 615.
[11] Duke-Elder, W. S. Nature of the Vitreous Body. Brit. Jour. Ophth., Monograph, Suppl. IV, 1930.
[12] Redslob, E. Le Corps Vitré. Paris, Masson et Cie, 1932.

SODIUM SULFACETIMIDE*

Its use in treatment of certain diseases of the eye

William L. Benedict, M.D., and John W. Henderson, M.D.
Rochester, Minnesota

In the search for a sulfonamide that was efficacious when applied locally for treatment of infections, Robson and Tebrich,,[1] and Robson and Scott,[2-5] all of Scotland, utilized the sodium salt of sulfacetimide in various concentrations in therapy of experimentally produced ulcers on the cornea of rabbits. Sodium sulfacetimide in 30-percent solution most nearly fulfilled their requirements for a drug with high solubility and adequate penetration, nonirritant effect, and a pH near the neutral point. Dickson[6-8] followed up this experimental work by applying the drug in solutions of 10 percent and 30 percent, respectively, to injured eyes of a large number of coal miners and factory workers in Scotland. He was enthusiastic as to the results obtained with albucid soluble (sodium sulfacetimide) and recommended its more widespread use in industry.

In the United States Kuhn,[9] working in factories of Illinois and Indiana, used the drug extensively in the follow-up treatment of patients from whose corneas foreign bodies had been removed. By prescribing a 30-percent solution as eye drops for use every four hours, supplemented by application of the drug as an ointment at night, he was able greatly to reduce the incidence of secondary infection following extraction of a foreign body. Kuhn felt that sodium sulfacetimide was more efficacious than other drugs or methods in the treatment of traumatic corneal ulcers in the convalescent stage. To a lesser extent he utilized the drug in treatment of acute and chronic conjunctivitis.

During the past 12 months, certain patients observed in the Section on Ophthal-

* From the Section on Ophthalmology, Mayo Clinic.

mology of the Mayo Clinic were treated with sodium sulfacetimide. This drug was utilized as the therapeutic agent in approximately 65 cases. The results obtained are reported herein.

For our clinical study we employed sodium sulfacetimide (albucid soluble)* as a 30-percent solution and a 10-percent ointment for the treatment of diseases of the external part of the eye other than those associated with trauma or foreign bodies. In those cases in which sodium sulfacetimide was administered, the treatment was not supplemented by use of any other medication. As controls, alternate patients received routine treatment. Cultures and smears to determine the conjunctival flora were not made as a routine, and no attempt was made to select patients for treatment with sodium sulfacetimide.

The drug gave best results in average cases of acute catarrhal conjunctivitis and acute conjunctivitis associated with purulent or mucopurulent discharge. We must agree with Kuhn's[9] statement that "80% of cases were practically well within thirty-six hours if we saw them in the first twelve hours." Even those individuals who did not apply treatment within the first 12 hours of illness obtained relief from some of the symptoms of conjunctivitis. We employed either a 10-percent ointment or a 30-percent solution every two hours in the treatment of these conditions. The solution seemed to give better results than the ointment. In cases of conjunctivitis with a secondary superficial keratitis or corneal ulcer, the ointment was more soothing than the solution. In these types of disease of the eye, the results obtained by use of sodium sulfacetimide were better than those obtained by use of mercurial solutions, penicillin, or other drugs of the sulfonamide group.

The results obtained in treatment of chronic types of catarrhal and follicular conjunctivitis were less startling than those obtained in treatment of acute varieties. However, the subjective alleviation of symptoms was remarkable; in fact, it was more striking than objective improvement. It was our impression that the duration of the chronic phase of conjunctivitis in cases in which sodium sulfacetimide was used was shortened as compared to that of cases in which other methods of treatment were used.

In treatment of blepharoconjuntivitis the drug was used both as a solution and an ointment; the solution was applied during waking hours and the ointment at night. Requests were received from some of the patients for an additional supply of the medicine several months after their departure from the clinic. Although this fact suggests that the patients approved use of the drug, it also indicates that the disease was still present. For the treatment of blepharoconjunctivitis, we do not feel that methods in which this drug is employed are superior to others but that the drug should be accepted as one, among others, that gives reasonably good results.

We employed sodium sulfacetimide in some cases of keratitis sicca complicated by secondary conjunctivitis. The drug promptly alleviated the conjunctivitis and brought patients a great deal of relief during the phase when artificial-tear solutions alone were inadequate.

In treatment of angular conjunctivitis, we did not find the drug superior to the usual preparations of zinc. In cases of vernal conjunctivitis and primary keratitis uncomplicated by conjunctivitis or corneal ulcer, the drug seemed to have no effect. There was no opportunity to test the effect of locally-applied sodium sulfacetimide on trachoma.

* The drug for this clinical survey was kindly furnished by Schering Corporation.

Sodium sulfacetimide was used successfully as a collyrium in some cases in which other drugs had produced dermatitis of the eyelids. Sensitivity to sodium sulfacetimide developed in one case; in practically all cases, however, the patients used a 30-percent solution with little complaint. In many instances a 30-percent solution was said to produce a burning sensation momentarily. Because of the high concentration of the drug in solution, a fine white precipitate usually appears on the cap of the dropper bottle and on the eyelashes. The patients always were warned of the tendency of this drug to precipitate.

The work of Kuhn, Dickson, and others would seem to indicate that sodium sulfacetimide should be used more widely than it is now for treatment of posttraumatic corneal ulcers occurring among industrial workers. Our experience with the drug indicates that it is safe and efficacious for routine use in many types of conjunctivitis occurring in patients seen in private practice.

Conclusion

A drug, sodium sulfacetimide (Schering Corporation), prepared as a 30-percent solution and a 10-percent ointment, was utilized in the treatment of certain diseases of the external part of the eye during the past year. The drug was found safe for average clinical use and seemed most efficacious for treatment of acute varieties of catarrhal and purulent conjunctivitis.

References

[1] Robson, J. M., and Tebrich, W. Brit. Med. Jour., 1942, v. 1, p. 687.
[2] Robson, J. M., and Scott, G. I. Nature, London, 1941, v. 148, p. 167.
[3] ———. Brit. Med. Jour., 1942, v. 1, p. 5.
[4] ———. Nature, London, 1942, v. 149, p. 581.
[5] ———. Lancet, 1943, v. 1, p. 100.
[6] Dickson, R. M. Brit. Jour. Ophth., 1942, v. 26, p. 529.
[7] ———. Brit. Jour. Phys. Med., 1944, v. 7, p. 77.
[8] ———. Brit. Jour. Ophth., 1943, v. 27, p. 544.
[9] Kuhn, H. S. Trans. Amer. Acad. Ophth., 1946, p. 210.

ANTITOXIN TREATMENT OF STAPHYLOCOCCIC CORNEAL ULCERATION*

JAMES H. ALLEN, M.D.
Iowa City, Iowa

Corneal lesions occurring in the course of staphylococcic blepharoconjunctivitis are of two varieties. One, superficial punctate epithelial keratitis, is frequently encountered during acute exacerbations of the conjunctival lesion. With adequate treatment of the conjunctivitis, the keratitis subsides without sequelae. The second and more serious corneal complication also occurs during an acute exacerbation of the conjunctivitis. It is characterized by the development of marginal corneal ulceration with underlying stromal infiltration, accompanied by iritis (figs. 1, 2, and 3) and unless brought under control may progress to the development of a ring ulcer of the cornea. This course was observed in one case resulting in loss of the globe and in stimulating a search for better treatment.

The logical therapeutic agent seemed to be antitoxin since corneal lesions had been produced experimentally by the instillation of staphylococcus toxin[1] onto the cornea. Therefore, 25 patients, all of the cases seen in the eye clinic between September, 1937, and September, 1940, with staphylococcic blepharoconjunctivitis and marginal corneal ulceration, were treated with antitoxin. The only additional treatment was the instillation of 0.2-percent aqueous solution of scopolamine hydrobromide onto the cornea to relieve photophobia.

After the etiologic diagnosis had been established, antitoxin was administered by daily intramuscular injections of 10,000 units. A total of 40,000 units was given to 22 patients; 50,000 units to one patient; 60,000 to one and 80,000 to another (tables 1, 2, and 3).

All of the patients in the series had blepharoconjunctivitis of both eyes; 11 had superficial punctate epithelial keratitis of one cornea and marginal ulceration with stromal infiltration in the other; the remaining 14 had the more severe corneal lesions in each eye. Little change was observed 24 hours after the first injection of antitoxin. However, definite improvement occurred within 48 hours. Conjunctival discharge and congestion diminished; superficial punctate epithelial lesions of the cornea decreased in number; and the corneal ulcers and infiltrations became smaller. Thereafter, improvement continued slowly in several cases and rapidly in a few. The majority of the corneal ulcers healed and the infiltrations disappeared in 5 to 7 days after the first injection of antitoxin (figs. 3 and 4). In three cases, healing occurred in three days; whereas, in two cases the lesions persisted for 10 days (see tables). Although superficial corneal scarring remained at the site of the ulcers, it was marginal and did not result in the loss of visual acuity in any patient.

In addition to the ocular lesions, one patient had an extensive sycosis vulgaris; two had an acneform eruption of the skin; and one had impetiginous lesions of the face. All of these manifestations regressed simultaneously with the improvement of the ocular lesions.

Before treatment, sensitivity tests were

*From the Department of Ophthalmology, College of Medicine, State University of Iowa, Iowa City, Iowa. Part of a study conducted under grants from the John and Mary R. Markle Foundation. Read at the 82nd Annual Meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

Fig. 1 (Allen). Marginal corneal ulceration and stromal infiltration in an acute exacerbation of staphylococcic blepharoconjunctivitis.

Fig. 2 (Allen). Marginal corneal ulceration and stromal infiltration in an acute exacerbation of staphylococcic blepharoconjunctivitis.

made on each patient by injecting 0.1 cc. of horse serum intradermally into one forearm and 0.1 cc. of the antitoxin intradermally into the other forearm. Although no hypersensitivity was revealed, 5 of the 25 patients developed serum reactions. The first and second patients developed severe serum sickness with high fever, lymphadenopathy, generalized aches and pains, stiffness of the joints, and rash over the abdomen, chest, and neck. These reactions subsided without sequelae. Three other patients had mild transitory reactions. One noticed hives

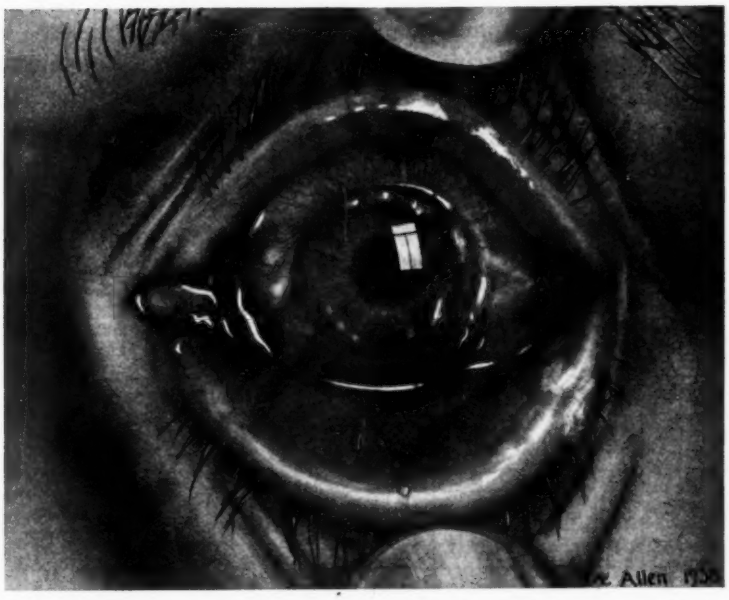


Fig. 3 (Allen). Appearance of left eye in Case 3 (table 1) before antitoxin treatment.

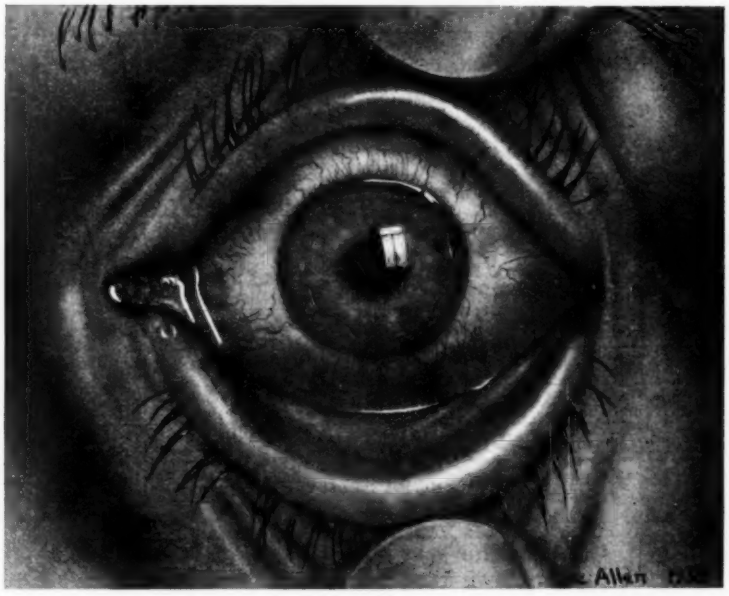


Fig. 4 (Allen). Appearance of left eye in Case 3 (table 1) seven days later.

in the region of the injections on the hips and at the sites of the skin tests on the arms four days after the first injection of antitoxin. The other two developed pain and stiffness of the joints associated with moderate elevation of temperature for one day on the 7th and 8th days after the first treatment.

Bacteriologic studies including aerobic and anaerobic cultures, scrapings, and secretion smears were made on these patients before, during, and after antitoxin treatment. Only staphylococci and occasionally Corynebacteria xerosis were found. In 23 cases the staphylococci were aureus and in two, albus. All strains

were hemolytic, fermented mannitol, and produced potent exotoxin. During and after treatment with antitoxin, there was no apparent reduction in the number of staphylococci.

lished after the corneal lesions healed. In 22 patients, the remaining conjunctival lesions slowly regressed. In one patient, a slight superficial punctate epithelial keratitis appeared 24 hours after the first

TABLE 1

SUMMARY OF CASES

CASE NO.	SEX	AGE	TYPE OF STAPHYLOCOCCUS	DURATION		LESIONS	UNITS OF ANTITOXIN	CORNEAL LESIONS HEALED	SERUM REACTION
				TOTAL FOR CONJUNCTIVITIS	ACUTE EXACERBATION	O.D. O.S.			
1	M	31	AUREUS	1 YEAR	1 WEEK		50,000	3 DAYS	SEVERE
2	"	13	"	2 YEARS	1 "		40,000	10 "	"
3	"	66	"	10 "	10 DAYS		"	7 "	NONE
4	"	25	"	SEVERAL MONTHS	15 "		"	3 "	"
5	"	55	"	6 MONTHS	15 "		"	3 " *	"
6	"	37	"	7 YEARS	3 "		"	5 "	"
7	"	49	"	2 "	3 MONTHS		"	5 "	MILD
8	F	67	"	3 WEEKS	3 WEEKS		"	10 "	"

* SUPERFICIAL ULCERATION OF LEFT CORNEA RECURRED AFTER EACH OF FIRST 5 INJECTIONS OF TOXOID.

TABLE 2

SUMMARY OF CASES

CASE NO.	SEX	AGE	TYPE OF STAPHYLOCOCCUS	DURATION		LESIONS	UNITS OF ANTITOXIN	CORNEAL LESIONS HEALED	SERUM REACTION
				TOTAL FOR CONJUNCTIVITIS	ACUTE EXACERBATION	O.D. O.S.			
9	M	47	AUREUS	SEVERAL YEARS	2 WEEKS		40,000	5 DAYS	NONE
10	"	72	"	"	1 WEEK		"	5 "	"
11	"	62	"	4 YEARS	"		"	6 "	"
12	F	54	"	SEVERAL WEEKS	SEVERAL WEEKS		"	6 "	"
13	"	58	"	8 WEEKS	8 WEEKS		"	5 "	"
14	M	72	"	SEVERAL YEARS	1 WEEK		"	5 "	"
15	"	38	"	1 MONTH	1 MONTH		"	9 " *	"
16	F	59	ALBUS	9 YEARS	2 WEEKS		"	5 "	"

* ULCER OF LEFT CORNEA RECURRED WITH FIRST INJECTION OF TOXOID AND BECAME SEVERE, REQUIRING FURTHER ANTITOXIN TREATMENT

Because of the persistence of exotoxin producing staphylococci upon the conjunctiva and the transitory nature of antitoxin therapy, active immunization with staphylococcus toxoid was estab-

injection of toxoid. It was associated with an exacerbation of the conjunctivitis. However, these lesions subsided rapidly and no further recurrences developed. Another patient developed a transitory

exacerbation of conjunctivitis associated with superficial ulceration of the cornea in the site of the previous corneal lesion after each of the first five injections of toxoid. A third patient, however, had an acute recurrence of all manifestations, including marginal corneal ulceration after the first injection of toxoid. The lesions were so severe that he was given antitoxin again, and combined toxoid and antitoxin treatment was continued until 140,000 units of antitoxin had been given before the exacerbations were controlled.

TABLE 3
SUMMARY OF CASES

CASE NO.	SEX	AGE	TYPE OF STAPHYLOCOCCUS	DURATION		LESIONS	UNITS OF ANTITOXIN	CORNEAL LESIONS HEALED	SERUM REACTION
				TOTAL FOR CONJUNCTIVITIS	ACUTE EXACERBATION	O.D. O.S.			
17	M	61	ALBUS	2 MONTHS	2 MONTHS		80,000	7 DAYS	NONE
18	F	31	AUREUS	1 YEAR	1 WEEK		40 000	6 "	"
19	M	22	"	"	10 DAYS		"	6 "	"
20	"	73	"	"	1 WEEK		60,000	6 "	"
21	"	37	"	3 YEARS	"		40,000	7 "	"
22	"	38	"	5 MONTHS	"		"	5 "	MILD
23	"	52	"	1 YEAR	"		"	5 "	NONE
24	"	36	"	21 YEARS	"		"	5 "	"
25	F	20	"	1 YEAR	2 WEEKS		"	5 "	"

DISCUSSION

The rapid response of both the conjunctival and corneal lesions to the administration of antitoxin furnishes clinical proof for the theory that toxin is an important factor in the production of staphylococcic conjunctivitis and corneal ulceration. The recurrence of superficial epithelial keratitis in two patients and severe corneal ulceration in a third, following the administration of toxoid, is further proof of the causative role of toxin.

Inasmuch as antitoxin therapy is transitory, it is of practical value only in severe staphylococcic infections to prevent permanent and irreparable damage to the cornea and should be followed by active immunization, chemotherapy, or antibiotic therapy.

Since this study was made, penicillin has proved to be effective in the treatment of many staphylococcic infections. However, Thygeson[2] has reported that approximately 20 percent of the strains of staphylococci isolated from the eye are resistant to penicillin. Therefore, antitoxin therapy should be useful in severe infections caused by penicillin-resistant strains of staphylococci.

SUMMARY

The acute manifestations of staphylococcic blepharoconjunctivitis complicated by corneal lesions subsided under antitoxin treatment in a series of 25 patients. Minor corneal lesions recurred in two cases, and severe corneal ulceration reappeared in one case immediately following the institution of toxoid therapy. Serum reactions occurred in 5 of the 25 patients even though skin tests failed to reveal hypersensitivity.

Conclusions

Both the response to antitoxin therapy and the relapses following the institution of toxoid therapy furnish clinical proof for the theory that toxin is an important factor in causing the acute lesions in staphylococcic ocular infections.

Antitoxin is of practical value as a temporary measure in the treatment of severe staphylococcic infections until active immunization, chemotherapy, or antibiotic therapy can become effective.

University Hospitals,
Newton Road

References

[1] Allen, J. H. Amer. Jour. Ophth., 1937, v. 20, Oct., pp. 1025-1030.
[2] Thygeson, Phillips. A study in military personnel. The Military Surgeon, 1946, v. 98, April, pp. 279-288.

MEDICAL ASSISTANCE AT PROFESSIONAL LEVEL*

Parker Heath, M.D.†
Boston, Massachusetts

Resultant of multiple factors, there is a shortage of physicians, and this shortage will continue for some years. How to extend medical care has, therefore, become the concern of many well-meaning people. The problem of more and better distribution of medical care is not likely to be met by any of the conventional measures and methods now in sight.

Lay interest has been and is largely political. Up to this time, it fails to tie threatened government aggressions with responsibility. The profession itself is taking various measures to overcome the shortage of physicians and their services. Among these measures are larger classes at undergraduate level, an increase in the number of residents and internes, provision for more fellowships, refresher courses, and basic-training programs in the specialties. Constantly improving methods of treatment and prevention of disease, the aftermaths of research and education, also give more, as well as better, medical care. Furthermore, medicine has trained certain lay people to care for the sick. Within this classification is the nurse; for the function of the nurse, when trained by medicine and practicing under its laws, is to care for the sick. Laboratory aides, X-ray technicians, office workers, and special workers in research, all trained in medical disciplines, have greatly enlarged the extent and the effectiveness of medical practice.

Despite all the above medically trained laymen, do we in ophthalmology have sufficient technical and professional assistance? Ophthalmology has not seriously gone into the problem of training high-level assistants except in orthoptics. The orthoptic technicians are excellent as far as they go, but they have a narrow range. Their opportunities for assistance are too limited, and the supply is restricted because recognized training centers are too few. Yet, ophthalmology in its various segments probably more than any other specialty is adaptable to professional assistance. Although both the already numerous methods of examination and the complications of instruments are increasing,

* From the Department of Ophthalmology, Wayne University College of Medicine, Detroit, Michigan. Read at the 82nd annual meeting of the American Ophthalmological Society at San Francisco, California, June, 1946.

† As of July 1, 1947, pathologist at the Massachusetts Eye and Ear Infirmary and clinical professor in the Department of Ophthalmology at Harvard Medical School.

no serious effort has been made to train a professional personnel, with the exception of orthoptics.

The obvious question arises—is it desirable to create such a group of medical assistants? Medicine has always been reluctant to teach lay people in the field of practice. This wariness is simply a protection to the public and aims to avoid increased health problems from low standards and quackery, for there have always been those at the fringe of Medicine who see many people.

For 2,500 years, an item in our code has been and now is to teach only those who follow and are controlled by the laws of Medicine. The current procedure of those groups operating on the fringe of Medicine is to write their own rules for their own advantage and economic administration. Using medical symbols, they continually press for more and more legal recognition, so that legal acceptance has come to possess but little professional merit in problems of health.

Schools, the military, industry, and civic organizations are badgered by these activities. The principles and the practice of caring for the sick are not, however, subject to short cuts in education or ethics. To achieve medical acceptance and to merit medical instruction and teaching, a lay group must accept and work within the laws of Medicine. The nurse has achieved this recognition.

A consistent and common pedagogic function of the physician is to train lay assistants by preceptorships. These persons, bound to the principles of Medicine by the physician's high standards and disciplines, greatly extend the range of his practice and reduce the onus of his daily grind. The overall effect is to extend high-level services over a larger number of patients. The gathering of data relating to the ocular health of an individual is sometimes a long and laborious process. Consequently, a medically educated and accredited personnel, trained to assist in this work, will extend the ophthalmologist's service and ease the burden of his practice.

What should be the educational scope of these assistants? The answer to this question has direct bearing on the possible contacts they may have with the overall practice of the ophthalmologists. While doubtless there would not be complete agreement as to which parts of the examination could be conducted by assistants, some ophthalmologists would assign one part and some others, still the following parts of an eye service may be listed as suitable for assignment to medical asistants at a professional level.

Refraction. Instillation of drops, shadow and subjective tests, not the history, muscle balance, tonometry, external and ophthalmoscopic examination, and prescription.

External diseases. Smears and cultures, some forms of therapy under supervision, photography if indicated.

Perimetry. Visual fields and scotometry.

Tonometry. Under supervision.

Orthoptics. The conduct of fusion training.

Ophthalmoscopy. Assistance in photography when indicated, note taking.

Biomicroscopy. Assistance in placing the patient, drawings and notes.

Gonioscopy. Assistance in placing the patient, drawings and notes.

Ocular Motility. Assistance in plotting and recording fields, and note taking.

Screening tests. In schools and industry.

Surgical. The care and preparation of instruments, assistance during the operation.

First Aid. In industry and schools.

Laboratory. Smears and cultures, tis-

sue sectioning, chemistry data recording, preparation of drugs and solutions.

Contact Glasses. Assistance in refraction and fitting of trial shells and molds.

Library. Collection of abstracts and references, assistance in preparation of papers.

Nursing Care. On occasion.

In practice most of us delegate parts of the examinations to trained personnel. This assistance is trained by the preceptor method—a method which requires many years and does not turn out enough well-rounded, trained people to meet the demands or the possibilities. From the experimental point of view, the preceptor-trained associate is a success. To increase their numbers, approved academic channels may be used. The admittance standards to the course of study leading to an ophthalmic associationship would be those of college entrance, plus aptitude. The suggested curriculum would run four years at college level and lead to a bachelor's degree. About half of the subject matter would be in the field of the humanities and would be taught by the literary and science faculties. History, English, and languages, biologic and social sciences would be conventionally proportioned. The last two years would be chiefly concerned with technical training and would be the responsibility of the medical teaching staff.

A technical curriculum is suggested in this outline of subjects and hours for the Junior and Senior years.

Subject	*Hours* (Lecture & Laboratory)
First Semester-Junior Year	
Anatomy—gross, head, neck, dissections. Includes comparative and embryology	240
Neuroanatomy	88
Bacteriology	72
Physiologic Chemistry	216
Histology of the Eye	144
Second Semester—Junior Year	
Psychiatry and Neurology	72
Physiology	216
Physiologic Optics	72
Pathology	216
Use of Medical Library	2
Clinical and Laboratory Technique	144
First Semester—Senior Year	
Refraction	288
Ocular Muscles	72
Orthoptics	140
Optical Manufacture	100
Contact Lens	20
Perimetry	200
Second Semester—Senior Year	
Biomicroscopy	12
Refraction	288
Tonometry	4
Orthoptics	140
Screening Methods	100
Nursing—Ophthalmic	50
Surgical Equipment	100
Medical Illustration	100
Office Practice	50
Statistics	10

Conclusions

The development of a professional group of ophthalmic associates will make a substantial contribution to medical care in our specialty. It can be created within existing educational facilities. The suggested program would run four years at college level and lead to a bachelor's degree. About half of the subject matter lies in the field of the humanities and would be taught by the literary and science faculties. The remainder is largely technical and is the responsibility of the medical teachers. The admittance standards would be those of college level plus aptitude. On successfully completing this course, the rewards to the associate and his acceptance by medicine should be consistent with his training, ability, and responsibilities. If the formation of this group within our field has survival value, it will be because it extends medical service and is better for the patient.

243 Charles Street (14).

THE USE OF FURMETHIDE IN COMPARISON WITH PILOCARPINE AND ESERINE FOR THE TREATMENT OF GLAUCOMA*

ELLA UHLER OWENS, M.D., AND ALAN C. WOODS, M.D.
Baltimore, Maryland

The results of the use of furmethide (furfuryl trimethyl ammonium iodide) in the treatment of glaucoma have been reported in two previous papers.[1,2] When these papers were published, furmethide was available only in small quantities, but it now appears that the drug will become available commercially. The purpose of this paper is to compare furmethide with the conventional drugs, pilocarpine and eserine, in the treatment of primary glaucoma.

The results in a group of 60 cases of primary glaucoma treated with pilocarpine and eserine were compared with the results in a group of 65 similar cases treated with furmethide. The ocular tension in all cases of both groups exceeded 40 mm. Hg (Schiøtz) before therapy. Cases of both congestive and noncongestive glaucoma were included in both groups. All of the patients were admitted to the hospital.

METHODS OF TREATMENT

The methods of treatment in the pilocarpine and eserine group were not as uniform as in the furmethide group. In the latter, all patients received one drop of a 10-percent solution of furmethide instilled into the conjunctival sac every 15 minutes for 2 hours, then every 3 hours until the tension had been reduced to normal, or until an operation had been performed. The methods of treatment in the pilocarpine and eserine group may be summarized as follows:

Pilocarpine (2-percent solution). 22 cases. Usually given every 2 hours; occasionally every hour or every 3 hours; rarely every 30 minutes for 4 doses, then every 3 hours.

Pilocarpine (1-percent solution). 7 cases. Usually given every 2 hours or every 3 hours; rarely every hour.

Pilocarpine and Eserine. 24 cases. Usually pilocarpine (2-percent solution), occasionally pilocarpine (1-percent or 5-percent solution) alternating with eserine (0.25-percent solution) every 2 hours; occasionally pilocarpine (2-percent solution) and eserine (0.25-percent solution) every 15 minutes for 1 hour, then every 2 or 3 hours.

Eserine. 7 cases. Usually eserine (0.25-percent solution), rarely eserine (0.50-percent or 1-percent solution) every 15 minutes for 1 hour, then every 3 hours.

RESULTS

The results are summarized in Table 1.

1. In the pilocarpine and eserine group (60 cases) the tension was reduced to 35 mm. Hg (Schiøtz) or less in 53 percent of the cases as compared with a similar reduction of tension in 77 percent of the cases treated with furmethide. This is statistically significant ($r = 2.9$).

2. Tension before therapy was over 55 mm. in 47 percent of the patients in the pilocarpine and eserine group. In the furmethide group, however, the initial tension was over 55 mm. in 62 percent of the patients. Thus furmethide was used in a group with higher initial tensions.

Comparison of the figures in Table 1 shows that furmethide was more effective than pilocarpine and eserine in treating

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

cases with initial tensions over 55 mm. ($r = 2.7$). It also appears to be more effective in treating patients with initial tensions less than 55 mm., although the results are not quite statistically significant ($r = 1.5$).

glaucoma whose tension had been uncontrolled by pilocarpine. The group included cases of congestive and noncongestive glaucoma. Before furmethide therapy was started the tension had been consistently elevated, varying from 30 to

TABLE 1

COMPARISON OF THE FAVORABLE EFFECT OF TREATMENT WITH FURMETHIDE AND WITH PILOCARPINE AND ESERINE ON VARIOUS STAGES OF PRIMARY GLAUCOMA: PERCENTAGE REDUCTION OF TENSION TO 35 MM. OR LESS

Treatment	Initial* Tension over 55 mm. Percent	Initial Tension under 55 mm. Percent	Late Cases Percent	Early Cases Percent	Total* Percent
Furmethide	75	80	67	79	77
Pilocarpine and Eserine Group	43	63	52	57	53

* Statistically significant difference in percentage.

3. Early and late glaucoma. The patients were divided into two groups, those with so-called early and late glaucoma. Cases of early glaucoma were considered to be those in which the field defect was less than 30 degrees in any meridian and the blind spot not enlarged more than 10 degrees in any diameter. According to this classification, 65 percent of the cases in the pilocarpine and eserine group had late glaucoma. In the furmethide group 70 percent of the cases had late glaucoma.

The table shows that furmethide was more effective than pilocarpine and eserine in treating both early and late cases, although the differences are not quite statistically significant: ($r = 1.4$) in the early cases, ($r = 1.5$) in the late cases.

COMMENT

Furmethide was also used in a separate group of 20 outpatients with primary

40 mm. Hg (Schiøtz). In half of these patients the tension was reduced to normal (25 mm. or less) by furmethide given in 10-percent solution from 3 to 6 times a day. As previously reported, these figures show that furmethide is effective in controlling the tension in certain cases where pilocarpine has failed.

CONCLUSIONS

1. Furmethide is more effective than pilocarpine and eserine in the treatment of cases of primary glaucoma in which the tension before therapy exceeds 40 mm. Hg (Schiøtz). It is especially valuable in cases in which the initial tension exceeds 55 mm. Hg (Schiøtz).

2. Furmethide is effective in certain cases of primary glaucoma in the lower tension groups in which treatment with pilocarpine has failed.

601 North Broadway (5).

REFERENCES

[1] Uhler, E. M. The use of furmethide in comparison with other miotics for the treatment of glaucoma. Amer. Jour. Ophth., 1943, v. 26, pp. 710-714.

[2] Owens, E. U., and Woods, A. C. Further studies on the use of furmethide in the treatment of glaucoma. Amer. Jour. Ophth., 1946, v. 29, pp. 447-450.

CEPHALOSPORIUM KERATITIS*

ARTHUR J. BEDELL, M.D.
Albany, New York

"Fundus infections are of such common occurrence that we have found it necessary to consider mycotic disease in the differential diagnosis of practically every obscure infection." With these words the authors of the *Manual of Clinical Mycology*[1] preface their excellent presentation.

Ophthalmologists have, as usual, been alert and able to suggest the methods of examination to prove the diagnosis of several of the mycoses such as the rare sporotrichosis and the common blastomycosis.

The physicians of the United States are now more fungus conscious than ever before, not only because more cases have been seen, but also because they are apprehensive that when the infected return from the Pacific they may spread the disease. So far this fear has not been justified.

Serra,[2] in 1929, reported the first case of ocular cephalosporium, a keratitis. He carried his cultural examination to a logical and exact termination. Maffei[3] confirmed Serra's observations and extended their scope.

Correlated and suggestive studies have been recorded by Morax[4] of a corneal ulcer with hypopyon caused by the verticillium graphii, and by McKee[5] in blastomycosis. An interesting citation of corneal involvement, caused by glenospora graphii, somewhat similar to the cephalosporium, was made by R. E. Wright.[6] The corneal slough was tough, with a slightly undermined edge and a grayish-yellow, tightly adherent central mass. Lundsgaard[7] reported a hypopyon keratitis with a mould and Stoewer[8] experimented with moulds in rabbits' eyes.

When, in 1932, Miller and Morrow[9] wrote about cephalosporiosis, they found only five cases in the literature, three gummalike and two superficial skin. Hartmann[10] called attention to the association of cephalosporium and trichophyton gypseum.

Other observers including Lewis and Hopper,[11] Grutz,[12] Boucher,[13] Benedek,[14] Cabrini and Redaelli,[15] Leao and Lobo,[16] Klebahn,[17] and Beym[18] have had clinical and laboratory experience with the various types of cephalosporium.

The most complete presentation is by Dodge.[19] Other recommended sources of information on the mycoses are the works of Ash and Spitz[20] and the *Manual of Clinical Mycology*[1] under the authorship of Conant, Martin, Smith, Baker, and Callaway.

CASE REPORT

A 41-year-old, rugged farmer was examined 10 days after his left eye had been injured when struck by a cow's tail. The cow was healthy and the accident such a common one that no attention was paid to it until the day before he was first seen when the eye became painful, red, and sensitive to light.

The right eye was negative externally. Vision in this eye was: 6/15 +2.50 6/5. Vision in the left eye was 6/15. The lids were red and swollen and the entire bulbar and palpebral conjunctiva was congested. The injection was greatest in the lower cul-de-sac and on the proximate globe. The cornea was clear, except in the lower outer quadrant where a 3-mm. gray ulcer with a soft, ill-defined margin was close to the limbus. The iris was congested, the

* Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

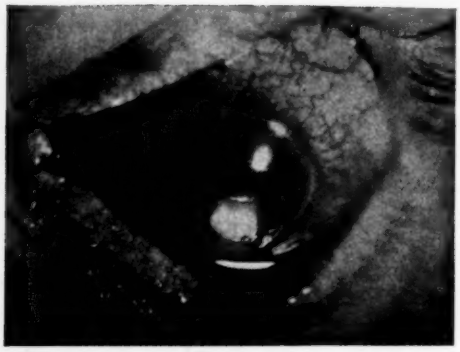


Fig. 1 (Bedell). Yellow-white corneal ulcer with a furled margin; hypopyon, ciliary congestion.

pupil measured 2.5 mm. and responded actively to light, although it only dilated to 4 mm. after the instillation of atropine. The aqueous was cloudy but there was no hypopyon.

Three drops of the aqueous solution of 5-percent sodium sulfathiazole were instilled into the lower cul-de-sac every two hours. After three days, the ulcer was unchanged. The entire area was then treated with tincture of iodine without any improvement. Penicillin (2,500 units to 1 gm. of white ointment) was put into the eye every hour, and under this treatment the infiltration increased.

The 3-mm. corneal ulcer was covered by a yellow-white, slightly wrinkled plaque. The peripheral portions were thickest and seemed to furl away from

Fig. 2 (Bedell). Five days later. Marked improvement. Ulcer less yellow, more circumscribed, hypopyon decreased.

the uninvolved surrounding cornea. There was a 2-mm. hypopyon, and the bulbar congestion continued to be greatest below. The culture yielded staphylococcus albus and a few Gram-positive cocci. The appearance of the ulcer was so suggestive of a mould growth that, although previous attempts to cultivate one had failed, potassium iodide was given internally.

Five days later, the improvement was sufficient to confirm clinically the diagnosis of mould. The ulcer was not only softer and more yellow, but was also markedly reduced in surface and depth. It was less than one half its former size and the hypopyon was about one quarter as large as formerly. The patient was taking 15 gr. of potassium iodide, three

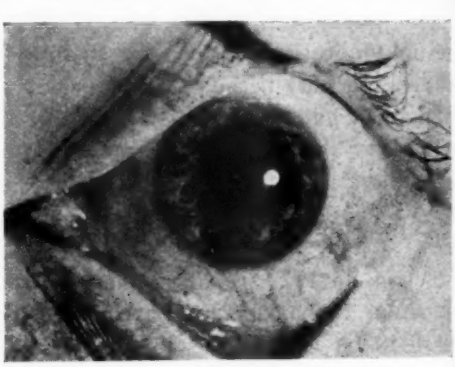


Fig. 3 (Bedell). Ulcer healed, thin scar, pupil dilated.

times a day. The cultures which proved the diagnosis were taken at this time.

Three days later there was no hypopyon and the corneal area was gray and slightly depressed.

When seen nine days later, the globe was whitening and the corneal facet had a smooth, light-reflecting base.

The improvement continued. When last examined, uncorrected vision was 6/12; and corrected vision was 6/6, with a +2.00D. sph. ⌒ +50D. cyl. ax. 180°. The corneal surface was smooth, and only a nebulous, round, superficial scar remained. The pupil was slightly irregular

with a fine arc of uveal pigment on the lens capsule.

Laboratory report

The report from the Albany Hospital and the Albany Medical College Laboratory by Dr. William Kaufman was:

"Cultures were taken on December 22, 1945. Two tubes of Sabouraud's dextrose agar and two tubes of cornmeal agar were inoculated. Growth on both media occurred after 24 to 36 hours at room-temperature incubation. Growth occurred rapidly and within five days the slants were completely overgrown. Forty-eight hours after inoculation, two Kille flasks, one containing Sabouraud's dextrose agar and the other containing cornmeal agar were inoculated with material grown on the slants. Growth occurred within 24 to 36 hours, and within one week the flasks were completely covered with the growth.

"Gross appearance of the Sabouraud-inoculated material (fig. 4): The colony is cottony and whitish with a slight pink sheen. There is a moderate amount of aerial growth.

"Gross appearance of the cornmeal-inoculated material: The colony is grayish-white, more granular than the former, and there are few, if any, aerial hyphae. Growth shows distinct purplish pigment.

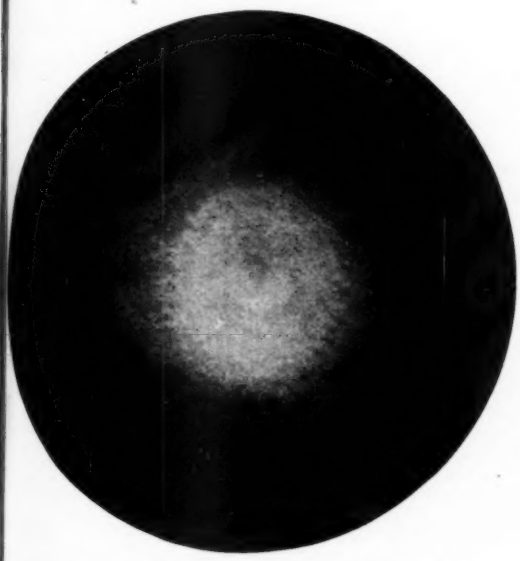


Fig. 4 (Bedell). Cottonlike growth with a fuscous tinge, after 36 hours' incubation on Sabouraud's media.

"Microscopic examination of material removed from the Sabouraud medium (fig. 5): There are numerous septate hyphae containing a fair number of granules. Racquet mycelium is frequently observed. A few hyphae containing arthrospores are seen. There is an abundance of ovoid spores (conidia). These are seen to grow laterally from the hyphae in groups of one or sometimes two, and in grapelike clusters from the end of the hyphae. Many of the conidia are often elongated and a large number are seen completely round and containing what appear to be crossbars, and these bars are found centrally as well as at the end of the conidia. There is considerable variation in size of the conidia. Occasional chlamydospores are seen.

Fig. 5 (Bedell). Unbranched conidiophores with many elliptical conidia.

"Diagnosis: Cephalosporium species."

Comment

A corneal ulcer, the result of an abrasion caused by a cow's tail, is described.

The first laboratory report was staphylococcus albus and a few Gram-positive cocci. The usual treatment including sulfathiazole and penicillin failed to check the infection. The clinical picture was so suggestive of a mould that potassium iodide was administered and a very satisfactory regression resulted. Subsequent investigations proved that the cause was the extremely rare cephalosporium species.

This cephalosporium infection of an eye is the second on record, for after a careful research of the literature only the case of Serra seems substantiated.

The response to potassium iodide was spectacular.

Conclusion

Any chronic corneal ulcer with a puckered plaque should be cultured for moulds.

I am indebted to Dr. Nathan Mitchell who zealously coöperated in many experiments on the cornea of rabbits. No exact duplication of the human ulcer was obtained, although the mould-infected cornea reacted more severely than the control.

344 State Street (6).

References

[1] Manual of Clinical Mycology. Military Manuals, National Research Council. Philadelphia, W. B. Saunders Co., 1945, p. 302.
[2] Serra. Osservazione clinica, studio batteriologico ed istopatologico. Ateneo parmense, 1929, v. 1, p. 549.
[3] Maffei. Pavia Univ. Instituto Botanico, 1929, Serie IV, v. 1, p. 183.
[4] Morax. Ann. d'ocul., Annes T. CXLIV, p. 13; Annee 1910, p. 323.
[5] McKee. International Clinics, 1926, v. 111, Sept., p. 50.
[6] Wright, R. E. Brit. Jour. Ophth., 1929, v. 13, Oct., p. 496
[7] Lundsgaard. Klin. M. f. Augenh., 1900, v. 38, p. 13.
[8] Stoewer. Graefe Arch. f. Ophth., 1899, v. 48, p. 178.
[9] Miller and Morrow. Arch. Dermat. & Syph., 1932, v. 25, p. 294.
[10] Hartmann. Dermat. Wchnschr., 1926, v. 82, p. 565.
[11] Lewis and Hopper. An Introduction to Medical Mycology. Chicago, The Year Book Publishers, 1943, p. 173.
[12] Grutz. Dermat. Wchnschr., 1925, Bd. LXXX, p. 765.
[13] Boucher. Bull. Soc. path. exot., 1918, v. 11, p. 306.
[14] Benedek. Arch. f. Dermat. u. Syph., 1928, Bd. CLIV, p. 96.
[15] Cabrini and Redaelli. Boll. d. Soc. med.-chir., Pavia, 1929, v. 4, no. 5, pp. 475-497.
[16] Leao and Lobo. Soc. de biol. de Rio de Janeiro, 1934, v. 117, p. 203.
[17] Klebahn. Phytopatol. Zeitsch. Band., 1; Heft., Berlin, 1929, v. 1, p. 32.
[18] Beym. Centralbl. f. Bakt., 1933, v. 130, p. 102.
[19] Dodge. Medical Mycology., St. Louis, C. V. Mosby Co., 1935, pp. 826-831.
[20] Ash and Spitz. Pathology of Tropical Diseases (An Atlas). Philadelphia, W. B. Saunders Co., 1945, p. 156.

FURTHER RESEARCH ON PANNUS FOLLICULARIS TRACHOMATOSUS

C. PASCHEFF, M.D.
Sofia, Bulgaria

In former publications,[1] I have attempted to prove that pannus trachomatosus is not always a simple "keratitis vasculosa superficialis," as it has often been designated, but a *follicular hyperplasia of the corneal conjunctiva.*

Since the publication of my early discussions of this question, the existence of follicular pannus has been confirmed by other authors also.[2] Nevertheless, I have continued my researches on a large scale and have found follicles in many cases of pannus trachomatosus, especially in its denser formations. The last of these observations demonstrates most clearly this thesis and should be recognized by all modern trachomatologists throughout the world. Its recognition is the more important in that such cases have become very rare in Bulgaria also, just as they have disappeared from many other countries of Europe.

CASE REPORT

M. D. K., a girl aged 18 years, led by her mother because she was blind, entered the University Eye Clinic on May 20, 1939.

Four years previously her eyes had begun to water and to be red. The condition became worse, as the months passed, and her vision began to diminish. During this time she was operated on by an ophthalmologist who expressed the conjunctival granulations.

After the operation she was improved and could still see. Six months later, her vision began progressively to fail; first in the right eye, then in the left. As stated, at the time of her admission to the Clinic vision was nil.

Examination. The patient was tall and of a weak constitution. She had suffered for some time from malaria. X-ray studies of the chest showed a tracheobronchial adenopathy with calcification of the glands of the left hilus. The Weil-Felix reaction was negative.

Blood studies gave the following results: R. B. C., 4,190,000; W. B. C. 6,500; hemoglobin, 78 percent; polymorphonuclears 60 percent (rods, 1 percent; segmented, 59 percent); lymphocytes, 34 percent; mononuclears, 4 percent; eosinophiles, 2 percent. The urine was normal.

Eye examination. A pronounced symptomatic ptosis with increased conjunctival secretion was observed. The conjunctiva of the superior tarsus was thick, rough, and toward the upper end, gelatinous in appearance. The same pathologic change was found in the lower lid also. In the plica semilunaris, the conjunctiva presented many follicles and large granulations. The scleral conjunctiva was more injected in its upper half than in the lower.

The cornea was covered with a thick, rough membrane rich in blood vessels, with fine ramifications throughout. Toward the upper limbus it was thicker and had taken on a granular aspect. Biomicroscopically, many follicles were seen. The membrane was so dense that it permitted observation of neither iris nor fundus.

Vision was perception of light.

The left eye. The condition of the conjunctiva was similar to that in the right eye; the cornea likewise was covered with a granular membrane which appeared to be thinner in the central portion. The iris could not be seen distinctly; illumination of the fundus was not successful. Vision

was equal to counting fingers at 20 cm.

Operation. The pannus of both eyes was excised with its adherent conjunctiva. Skin from the lower lid was transplanted to the right eye; mucous membrane from

Fig. 1 (Pascheff). Pannus follicularis of the right eye (low power).

the mouth to the left eye (Denig's method).

The patient left the Clinic two months later with vision sufficing only to count fingers at 20 cm. with the right eye; 6/50 with the left.

On October 9, 1939, the patient returned to the Clinic with vision in the right eye increased to 6/50; in the left eye, diminished to light perception.

Upon examining the left eye it was found that the transplanted mucous membrane was red, thick, and showed many follicles on its surface. The secretion was moderate. After some treatment the membrane was removed, and skin from the lower lid was transplanted. The patient left the Clinic on November 9th with vision equal to 6/50 with each eye.

This patient has been under constant observation for the last six years. Her vision has improved to R.E. 6/20; L.E. 6/15. The transplanted skin has become white and brilliant; the transparency of the cornea has increased considerably; neither cornea nor conjunctiva has had a recurrence of the condition. The patient is married and has healthy children.

Histology. The three biopsy specimens were fixed in formalin, hardened in alcohol, and embedded in paraffin. The sections were variously stained: with hematoxylin and eosin, Van Gieson, Giemsa, also with other stains.

Histologic examination of the thickened portion of the biopsy specimens gave the following results: (1) pannus of the cornea of the right eye. Under low power (fig. 1) the formation of numerous grains of different size and form were seen scattered under the epithelium, which, in some places, was well preserved, in others infiltrated and even destroyed. The grains had pale centers surrounded partly by a more deeply stained cellular zone at the periphery. Between the grains the tissue was infiltrated to a greater or less degree.

Under high power (fig. 2) the grains appeared to be lymphatic follicles with germinating centers having a more or less distinct peripheral lymphocellular zone.

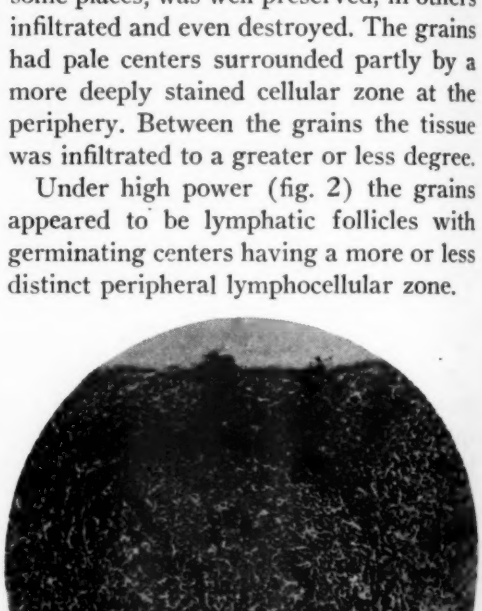


Fig. 2 (Pascheff). Pannus follicularis of the right eye. A follicle of the same pannus under higher power.

The cellular infiltration between these follicles consisted of many lymphocytes and plasmocytes. In the germinating centers were seen actively proliferating lymphocytes, histiocytes, endothelial cells, and many macrophages or phagocytes of

Villard. The latter were especially observable near blood vessels whose capillaries penetrated even into the germinating centers of the follicles. The latter were in different states of evolution but were for the most part individual.

(2) The pannus of the left eye (fig. 3) under low power showed the same grains in the densest part but these were of different lengths. They became fewer in number but longer. The epithelium was infiltrated in some places and had been destroyed in others. Between the follicles the tissue was moderately infiltrated. The grains had pale centers and more darkly stained peripheral cellular zones. Under higher power (fig. 4) it was seen that histologically they were *follicles with germinating centers.* In some sections the follicles were separated by connective tissue, richly infiltrated; in others, the follicles had coalesced and had formed large granulations—which I have termed *folliculoms.* Clinically the confluent follicles

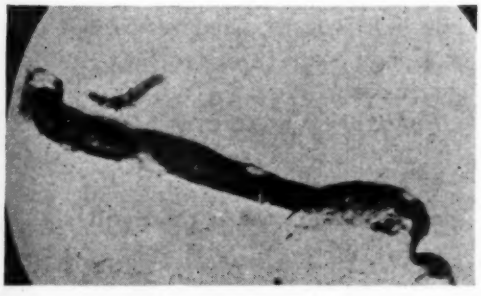


Fig. 3 (Pascheff). Pannus follicularis of the left eye (low power).

resembled small sausages. The germinating centers contained the same cellular elements as those described for the right eye.

(3) The follicular mucous membrane of the transplant showed the following histologic structure: The whole membrane was richly infiltrated with numerous follicles with germinating centers as afore described. I have seen such a recurrence with formation of follicles in the transplanted membrane in other cases wherein the pannus had been removed

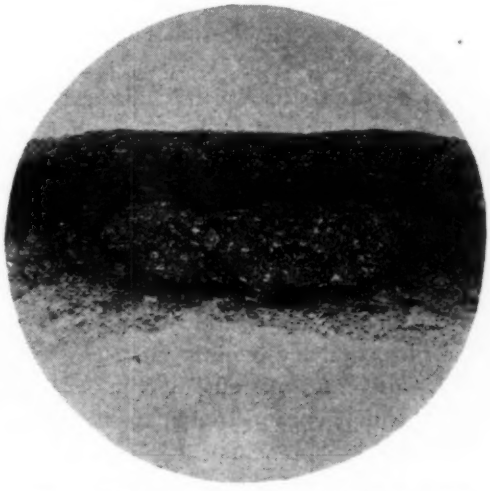


Fig. 4 (Pascheff). Pannus follicularis of the left eye. Follicles in a state of confluence (higher power).

and a transplant of mucous membrane had been made.[3]

Discussion

This case presents the best proof available up to this time of the existence of follicular pannus. In this instance it occurred bilaterally. The follicles were observed as individual germinating centers and in coalescence. Their histologic structure and development were similar to those observed in true trachoma of the conjunctiva, although this development was independent of the rest of the conjunctiva. In fact, I have observed many cases of follicular pannus developing on the cornea when the remaining trachomatous conjunctiva had advanced to the stage of cicatrization. This individual role of the corneal limbus in chronic hyperplasia of the conjunctiva is still more strikingly apparent in vernal conjunctivitis.[4]

Follicular pannus makes it first appearance between the epithelium of the cornea and Bowman's membrane. Later it

invades and destroys the latter. If follicular pannus is removed surgically, vision returns unless there is a recurrence. To avert the latter, skin must be transplanted to the eye instead of oral mucous membrane.

As to the nature of follicular pannus, it has been shown to have a lymphoid, reticulo-endothelial structure, rich in germinating centers which, in their further development, coalesce, degenerate, and cicatrize, as in true trachoma.

In this respect, follicular pannus of true trachoma is entirely different from the fibropapillary pannus[5] of vernal conjunctivitis and pannus lymphaticus[6] of phlyctenular conjunctivitis. In its further stage of development it has been erroneously considered by some writers to be a granuloma of the cornea. As I have demonstrated, the latter has a different structure histologically.[7]

Finally, follicular pannus is histologically entirely different also from the granular form of lupus—keratoconjunctivitis granulosa luposa[8]—in which the whole conjunctiva of the sclera and cornea takes on a granular appearance such as is seen in conjunctivitis milliaris follicularis,[3] but with these differences, it has no lymphatic follicles and the granular pannus of lupus is directly continuous with the granular conjunctiva.

In this last respect follicular pannus resembles closely the fibropapillary pannus of vernal conjunctivitis, for both begin at the limbus and generally are quite independent of the state of the scleral conjunctiva.

Conclusion

1. Follicular pannus is a lymphofollicular hyperplastic manifestation or reaction of the limbal corneal conjunctiva, and has the same histologic structure and evolution found in trachoma verum. 2. True trachoma, therefore, is not an exudative inflammation of the conjunctiva but a chronic lymphofollicular hyperplasia of the conjunctiva. 3. Although differing in structure, pannus follicularis calls to mind the fibropapillary reaction of the conjunctiva—pannus fibropapillaris—which today is considered an allergic reaction. 4. The best way to avoid recurrence is to transplant skin from the lid instead of mucous membrane.

Rakowsky Str., Asparuch 48.

References

[1] Pascheff, C. Ueber Trachoma verum corneae und sein Wesen. Graefe's Arch., 1914, v. 87, no. 3.
[2] Bardelli. Il tracomo. 1940.
[3] Pascheff, C. Researches on the follicular diseases of the conjunctiva. Amer. Jour. Ophth., 1938, v. 15, no. 8.
[4] ———. La formation des follicules dans la transplantation de Denig. Congrés int. d'Opht., Cairo, 1937.
[5] ———. Recherches sur les formes cornéenes et sclérales printanière-fibropapillaire. Congrés int. d'Opht., Cairo, 1937.
[6] ———. Recherches sur la tuberculose oculaire. Académie des Sciences, Sofia, 1934.
[7] ———. Richerce sul granuloma della cornea. Boll. d'Ocul., 1938.
[8] ———. Ophthalmologie spéciale. In "Diseases of the eye." Sofia, 1946.

THE PLACE OF PERIPHERAL FUSION IN ORTHOPTICS*

HERMANN M. BURIAN, M.D.
Boston

The division of fusion into three degrees, suggested by Worth, is generally accepted in orthoptic circles. This division may be convenient from a practical point of view, but if it is routinely and mechanically applied, it leads to blurring and oversimplification of a complex process. There is an important distinction which is not explicitly made in this division; namely, the distinction between sensory and motor fusion. To understand this distinction and the place which I believe peripheral fusional stimulation to hold in orthoptics, a word on fusion in general is necessary.

SENSORY AND MOTOR FUSION

Sensory fusion means the act of uniting into a single mental image the impressions reaching certain areas of the two retinas. Such unification takes place, in normal individuals, when corresponding retinal points or elements are stimulated. Around each corresponding retinal element, however, there is an area which, although not strictly corresponding or even frankly disparate, also permits unification of biretinal stimulations into single mental images. These areas are known as the areas of single vision of Panum. If there is within these areas a horizontal disparity between the images of the right retina and the left retina, the resulting fused image has the quality of stereopsis.

Generally speaking, then, in order to produce a single image, biretinal stimulations must fall on corresponding retinal elements or at least within Panum's areas. If they fall outside of these areas, fusion does not occur, but diplopia results.

Motor fusion. The human organism has a pronounced aversion to diplopia—a diplopia-phobia, to use the term coined by Van der Hoeve. In order to establish single binocular vision, disparately imaged objects are brought within Panum's areas and on corresponding points by disjunctive horizontal, vertical, or torsional movements of the eyes. These movements of adjustment are the vergences or fusional movements. They represent what is called motor fusion.

The senory unification of biretinal stimulations must be distinguished from the reflex movements which occur, when necessary, to make this unification possible. A patient's ability to perform one of these functions does not necessarily imply the presence of the other.

The sensory stimulus for the fusional movements is the disparity of the retinal images. It is as though each pair of corresponding retinal elements was the center of a field of attraction. If similar images occur at different points in this field of attraction, a relative movement of the eyes is produced which ceases when the two images overlap. The farther away from the center the image is located, the weaker is the attraction. Beyond certain limits, marked by the range of the fusional movements, the attraction ceases altogether. If the movement has taken place, then sensory fusion follows motor fusion. This is what happens under normal conditions, with people who have all three degrees of fusion.

DEGREES OF FUSION

The first degree is known as "simultaneous macular perception." A patient is

* Read before the meeting of the American Association of Orthoptic Technicians at Chicago, October 14, 1946.

said to have the first degree of fusion, if he perceives simultaneously and superimposes two nonidentical pictures presented simultaneously to the macular areas. This, evidently, is purely an act of sensory fusion.

It is supposed to be the simplest form or lowest degree of the fusion faculty, the necessary prerequisite for the second and third degrees.

Now, actually, this is by no means as simple as it sounds. To be sure, normal individuals can as a rule easily superimpose these "first-degree pictures," although they often do it more easily with pictures containing fusional stimuli. However, patients with concomitant strabismus often have great difficulties in this. They try, above all, to avoid bimacular stimulation. They will suppress, they will change the angle of squint, they will change the mode of sensory localization —all in an effort to avoid bimacular stimulation. Although they may apparently not even have the first degree of fusion, one can, nevertheless, show that some of them have a rather well-developed fusion faculty. I have seen in many instances that if the stimulation of the macular areas is avoided, such patients not only have good sensory fusion, but they even exhibit fusional movements in response to disparate stimulations. Simultaneous macular perception, then, is not necessarily the "first degree" of fusion in patients with strabismus.

Worth's second degree of fusion is present when the patient can fuse dissimilar pictures and has some degree of fusional amplitudes. This second degree is concerned both with sensory and with motor fusion. It may be present, as I have just pointed out, in patients who do not display the first degree, if there is a special distribution of the stimulus pattern. The second degree is of particular interest in the discussion of fusional movements produced by disparate stimulation of more peripheral retinal areas.

The third degree, finally, is achieved when the patient has stereopsis. Depth perception is a sensation *sui generis* which is ordinarily based on the fusion of disparate retinal images. It has some independence from fusion, both sensory and motor, for it can occur in diplopia. Since, in my opinion, it is a fundamental sensation, it cannot be *taught.* It is as little a matter of experience and as little teachable as the sensation of red or green. What can be taught, is the refinement of stereopsis. Once a patient does have stereopsis, he can be trained, within limits, to discriminate ever finer differences in retinal disparities and to perceive them as depth differences.

A close analysis does not leave much to say on behalf of Worth's three degrees of fusion. The first degree is not as fundamental as appears at first glance. It may be absent in patients in whom the second degree may be shown to be present. The third degree, stereopsis, is really not the highest degree of fusion but rather a sensation *sui generis.* To be sure, it ordinarily presupposes sensory fusion as well as the presence of fusional amplitudes, but the latter in particular are accessories not essential to the sensation. Strictly speaking, therefore, stereopsis is not the highest degree of fusion.

Peripheral retinal stimuli

Some of the deductions which I have just presented to you are the result of studies which I undertook several years ago to investigate the part played by more peripheral areas of the retinas in the act of motor fusion.[1, 2] These investigations were carried out by means of an instrumentation which was briefly as follows.

Technique

The patient is seated at 15 feet from

an aluminized projection screen, with his head fixed in a headrest. Behind him are two projection lanterns placed on an adjustable stand. The beams of these lanterns are projected on the screen by adjustable mirrors. The mirrors, as well as the lanterns, pivot around a vertical axis; the projectors can be raised and lowered. Thus, they form a haploscopic arrangement, and targets projected by them can be placed independently on any desired region of the screen.

To dissociate the eyes, polaroid material is used. By placing the plane of polarization vertically in front of one eye and horizontally in front of the other eye, and by attaching corresponding sheets of polaroid material at the end of the tubes of the projection lanterns, a pretty good extinction is obtained. As a result, the targets projected by one lantern are seen only with one eye; the targets projected by the other lantern with the other eye. A third projector is used for auxiliary purposes. It, too, may be provided with polaroid. If it is desired to project a binocularly seen object, the polaroid is removed from that projector.

In order to have a check on the position of the eyes, two small movable projectors are placed one on each side of the patient. Each of these projectors also has a polaroid filter. As a rule, a short red and a short green line, each seen by one eye, are projected by these lanterns. One line is placed so that it corresponds to the fovea of the fixating eye; the position of the other line is adjusted by the patient. He keeps the two test lines always on a level or above each other by means of a handle on the projector. The position of the lines on the screen indicates directly the position of the eyes in patients with concomitant strabismus and normal correspondence. In anomalous correspondence, the position of the test lines tells the angle of anomaly.

This projection arrangement is extremely flexible. In normal individuals, it can be used to examine fusional amplitudes by stimulating any desired retinal area. Stereopsis at distance can be measured if stereoscopic slides are used in the haploscopic target projectors.

In patients with strabismus, one can measure within the limits of the screen the objective and subjective angles, if a tangent scale is projected by the auxiliary lamp. Sensory fusion in any area can be tested. Fusional amplitudes can be determined by stimulating or excluding from stimulation any desired area.

Preliminary investigations

In applying this instrumentation in preliminary investigations to normal individuals,[1] I found, as was to be expected, that fusional movements can be produced by disparate identical stimulations applied to the retinal periphery. I could, for example, produce typical fusional movements by presenting identical squares to the peripheries of the retinas of the dissociated eyes. These squares were at first superimposed on the screen and then slowly moved up and down, relative to each other, until the disparity of the retinal images became so large that they no longer produced an impulse to fusion. Although the observer usually saw these squares in the periphery, he was not always aware of the shapes, particularly if the squares were well out in the periphery. Their effect on the position of the eyes was determined by the test lines on which the observer concentrated his attention.

As was also to be expected, to obtain a standard amount of fusional amplitude the size of the stimuli had to be larger the farther away from the macula they were placed.

It was most interesting, however, to find that with targets of appropriate size

it was possible to achieve such powerful peripheral fusional stimuli that central fusion could be broken up. That is, if an observer fixated binocularly and fused a centrally seen object, it was possible to break the central fusion by strong peripheral fusional stimuli, and the binocularly seen object would appear double no matter how hard the observer tried to maintain central fusion.

Strabismus patients studied

The examination of patients with concomitant strabismus yielded many very interesting results with regard to the visual act in strabismus.[2] I can mention here only those which I believe to have a direct bearing on orthoptic practice.

The patients studied had a convergent or divergent strabismus with every type of sensory reaction. The only thing which they all had in common was that the angle of squint did not exceed 12 degrees because of the physical limitations of the screen. This was no handicap, since patients with a relatively small angle of squint are the ones who are most important from the orthoptist's point of view. As a rule, larger angles have to be reduced by surgery before the patient is submitted to visual training. All patients were thoroughly tested not only with the routine methods, but also with the various tests which the projection arrangement offered.

Now, I was able to show beyond any doubt that some of these patients were able to perform fusional movements when tested in an appropriate way with the projection instrument, although there was no trace of fusional movements when the patients were examined with the routine methods. This was a significant finding, since all the best authorities had heretofore absolutely denied the existence of fusional movements in the presence of a manifest strabismus. It was even more interesting to learn under what condition these fusional movements would come about.

I soon found in the tests preliminary to the application of disparate stimulations that two modes of response to central (macular or foveal) stimulations could be distinguished, irrespective of the state of retinal correspondence. The patients were either able to superimpose macular stimulations or they were not. For instance, if I projected a Maddox cross seen by one eye, and a movable red dot seen by the other eye, and asked the patient to move the red dot so that it would subjectively cover the zero of the scale, certain patients would place the dot without hesitation on a point on the screen corresponding to their (normal or anomalous) subjective angle and would state that the dot was now on zero. Other patients were quite unable to do this. They would move the dot until it approached the area on the screen corresponding to the visual line of the deviated eye (or the zero of the scale in anomalous correspondence). Then, suddenly, they would find that either that area of the scale or the dot had disappeared (suppression); or else the dot would suddenly jump to the other side of the scale because of a change in the sensory relation of the retinas (from anomalous to normal correspondence or *vice versa*); or, finally, the zero of the scale would keep creeping away when the dot approached, or make a slight shift to the other side of the dot, owing to changes in the angle of squint. All of these patients were unable to superimpose subjectively the dot and the zero of the scale in spite of patiently repeated attempts.

Results

In this way, I could differentiate patients who presented a central sensory disturbance from those who showed no

such disturbance. It proved that these patients also behaved differently with respect to peripherally applied fusional stimulations.

Those who had no sensory disturbance did not follow peripheral fusional stimulations. When the targets were displaced vertically, either at the angle of squint or at the angle of anomaly (if the correspondence was anomalous), their eyes did not follow the disparate stimulation. They either saw the displaced targets double or, more frequently, suppressed one retinal periphery.

Those, however, who had a central sensory disturbance in the majority of the cases did follow peripheral disparate stimulations in a typical way and under one condition only—stimulation of the retinal centers had to be avoided.

The patients, with central sensory disturbance, who did not follow peripheral fusional stimulations were generally those who totally suppressed all stimulations reaching one retina; in other words, those who had complete monocular vision, as for instance in alternating divergent strabismus.

Orthoptic use of peripheral retina

These results seem to me to be of considerable interest for those concerned with visual reëducation.

I believe that it is important for the orthoptist to know that peripheral fusional stimuli are very strong and capable of dominating the fusional impulses from the macular areas. By concentrating almost exclusively on central retinal areas in training binocular vision and fusional amplitudes, a powerful tool is being neglected. I am sure that in all cases favorable results could be obtained much more rapidly if use were made of the large areas of peripheral retina which are so highly responsive to disparate stimulation.

On the other hand, it is certainly significant that it is possible to diagnose, as it were, the seat of the sensory disturbance in a patient. It is not sufficient to say that a patient has or has not "first degree of fusion." The sensory behavior of the retinal periphery must also be investigated. If it is found that the patient has a marked aversion toward simultaneous stimulation of the macular areas but that he fuses with peripheral areas when the center is excluded, it would seem that the long battle between the orthoptist and the patient to establish he first degree of fusion could be won more easily and quickly by the orthoptist if she did not insist on the frontal attack on the macular areas of the patient. She should first concern herself with the peripheral areas which would more readily yield to her ministrations and should then infiltrate from there the macular areas. This should be the most effective way to overcome the sensory disturbance of the central retinal regions.

Finally, I should like to point out that there is one condition in which only peripheral retinal stimulations can be effective. This is cyclophoria. I have no personal experience with the training of cyclofusional amplitudes and do not know whether or not they can be trained. However, I do not see any theoretical reason why this should not be possible. If it is possible, it could only be achieved by stimuli placed at some distance from the retinal center. If you think of the eye as a wheel and of the visual line as a rod, the end of which is put through the center of that wheel, you will readily see how much easier it would be to turn the wheel by one of the spokes than by the rod.

Conclusion

If I should conclude by saying that, for all the reasons brought forth, the orthoptist should always study the sen-

sory behavior of the peripheral as well as the central areas and make use of the training potentialities of the retinal peripheries, this question is in order—what should be done about the practical application of fusional stimulations?

Unfortunately, I am not prepared to answer this question at this time. I cannot report any experiences in actual orthoptic training along the lines suggested. Conditions during the past years made it impossible to develop a method or to apply it in practice. I think that the ordinary major amblyoscopes do not offer a sufficiently large field of vision and are not flexible enough. I see no reason, however, why a simplified projection arrangement could not be developed to be used for orthoptic training of all types of disturbances.

I have found, for instance, accidentally and without looking for it, that what is known to the orthoptist as "massage" of the macula can be achieved with the projection arrangement herein described, most successfully and with very little physical effort. For this purpose the Maddox tangent scale, seen by the patient with the fixating eye, and a small colored light spot can be used. The light spot can be moved easily and with any desired speed over any area of the screen. If it is moved rapidly in the region of the visual line of the deviated eye, patients whose anomalous correspondence is not too deeply rooted will soon report that the spot suddenly "jumped" to the other side of the screen; that is, these patients now localize according to normal correspondence.

This is only an example of how the projection arrangement can be applied. Its most important application, however, lies in the possibility of reaching, during the exercises, one retinal area while at the same time excluding others.

It should be mentioned here that even without the use of a projection arrangement, the principle of simultaneous stimulation of peripheral retinal areas can be utilized. Swan and Laughlin[3] have reported encouraging results in developing single binocular vision in patients with high amblyopia ex anopsia and absolute central scotoma in the afflicted eye by using large ring targets. A green ring with a central dot for fixation was presented to the normal eye and a red ring with a blank background to the amblyopic eye. The authors state that, with training, many patients lacking sharp central vision fuse the rings and develop a considerable amplitude of fusional movements.

At present, I cannot make more definite practical suggestions, but I hope that I have indicated the important place which peripheral fusional stimulations should take in orthoptic training. I shall be much gratified if I have been able to arouse some interest in this subject.

520 Commonwealth Avenue (15).

References

[1] Burian, H. M. Fusional movements: Role of peripheral retinal stimuli. Arch. of Ophth., 1939, v. 21, March, pp. 486-491.

[2] Burian, H. M. Fusional movements in permanent strabismus: A study of the role of central and peripheral retinal regions in the act of binocular vision in squint. Arch. of Ophth., 1941, v. 26, October, pp. 626-650.

[3] Swan, K. C., and Laughlin, E. Binocular orthoptic training for amblyopic patients. Arch. of Ophth., 1944, v. 32, October, pp. 302-303.

Discussion of Dr. Burian's paper

Elsie Laughlin
Iowa City, Iowa

It is difficult to evaluate the full significance of diagnostic material such as Dr. Burian has presented, but we can appreciate the amount of study and research that made this presentation possible. I should like, at this time, to be able to present orthoptic data sufficient in quantity and quality to substantiate Dr. Burian's findings. Lacking the statistics for such a discussion, I shall begin by expressing my admiration and continue by accepting the challenge he has given us as orthoptists.

The idea of peripheral fusional training is not new at our clinic. For the past several years, we have used peripheral-fusion tactics at Iowa in an attempt to improve the chances for single binocular vision in patients with amblyopia. Recognition of the possibilities in this field of orthoptics led us to believe that we could help a number of patients with neglected monocular strabismus and offer them more than a purely cosmetic correction.

Our first observation of peripheral fusional movements was probably prompted by the considerable number of amblyopic patients who were also accommodative. This led to a more careful study of the binocular behavior of amblyopes at the synoptoscope and to the development of our simple peripheral fusion charts.

The targets consist of rings with a diameter subtending a visual angle of about five degrees. A green ring with a central dot for fixation is presented to the normal eye, while a red ring with a blank background is presented to the amblyopic eye. The ring, of course, must subtend a visual angle larger than the scotoma. These targets are used in the synoptoscope, which is adjusted by the corneal reflex method to correspond to the deviation of the eyes. In cases where normal retinal correspondence can be demonstrated and where the deviation is not too great, the patient is instructed to carry on with similar peripheral fusion targets in the stereoscope at home. Even the small percentage of cases in which favorable results are obtained warrants the continued use of this type of fusion training. I am sorry that not enough has been done to allow a more comprehensive report. It is obvious that perseverance is difficult in these cases for the same reason that characterized their delayed initial examination. In a busy clinic, the time element involved in treating these cases orthoptically is another factor to be considered.

Returning to Dr. Burian's statement concerning the division of fusion, I admit that I have always found it difficult to classify my patients as having first, second, or third-degree fusion. I am grateful that our doctors have not insisted upon such a classification. In our clinic, we use a graphic description of the status of simultaneous perception and vergences, which is supplemented by numerous marginal qualifying notations. This seems to serve our purpose in recording initial and subsequent findings.

Infiltration of macular areas

Dr. Burian's suggestion that we infiltrate the macular areas after good peripheral fusion has been established seems logical. A method of reducing the angle of anomaly in anomalous retinal correspondence was described by Miss Walraven at the recent meeting in Boston. Starting beyond the subjective angle with one arm of the major amblyoscope sta-

tionary at zero, the opposite target is brought in repeatedly until suppression takes place, and is then moved back each time until simultaneous perception is recovered. As the targets move through the subjective angle, the patient may become aware of monocular diplopia. This diplopia is used as a tool to obtain eventual fusion at the objective angle. Is this a preliminary step in peripheral training? Miss Walraven accomplishes this with the major amblyoscope. A projection arrangement would, no doubt, have added value, if its manipulation and the gyrations of the child could be controlled as readily as is possible on the major amblyoscope.

A variation of the red-green test, somewhat similar to the projection arrangement described by Dr. Burian, is at present being used in our clinic, purely as a testing device to verify synoptoscope and after-image findings. It has possibilities as a training device when certain mechanical improvements can be made.

By inducing consciousness of the periphery, are we making an initial move toward peripheral fusional training? We use a vertical prism to displace one image to a peripheral area where it is not suppressed, thus giving a patient his first awareness of diplopia. Miss Lancaster's bar-reading technique begins by making the child aware of a double bar at a near point when fixation is on a more distant object. These images of the bar fall upon disparate retinal areas. Gradually the bar is moved toward the fixated object, thereby varying the peripheral areas brought into use. Each time suppression takes place, the process is repeated. Can this be called infiltration of the macular areas?

As Dr. Burian points out, certain patients show a strong aversion to bimacular stimulation and are unable to superimpose dissimilar pictures (according to Worth's first-degree fusion). They often describe these targets as jumping around or over each other. We use partially identical targets (two pairs of simple 10-mm. colored balls which are fused as three balls). These targets allow for some central suppression and uncover any latent tendency toward peripheral fusion. They provide a starting point for most patients and those capable of single central binocular vision readily go on to more detailed binocular tasks. Dissimilar targets, such as the fish and the bowl, are used for testing the status of retinal correspondence in very young children at the synoptoscope.

I share Dr. Burian's opinion that stereopsis cannot be taught. Our experience seems to indicate that even in phoria cases, unless the loss of depth perception is associated with a small degree of suppression, no improvement in stereopsis follows orthoptic treatment. When suppression is present, stereopsis appears simultaneously as suppression is overcome.

Dr. Burian's extensive study of sensorial retinal relationships has made it possible for us to evaluate better the binocular behavior we encounter from day to day. I am sure he has succeeded in arousing an interest in peripheral fusional stimulations which will be manifested in future orthoptic procedures.

University Hospitals, Newton Road.

NOTES, CASES, INSTRUMENTS

WETTING AGENT FOR CONTACT LENSES

R. L. SCHMIDTKE, M.D.
St. Paul, Minnesota

Although the present day plastic contact lenses are a great improvement over both the Müller and the Zeiss glass contact lenses, there still are many problems that vex the ophthalmologist who prescribes and fits contact lenses. The most frequent complaint is fogging. The following are some of the more common causes for the fogging of vision experienced by the wearer of contact lenses: (1) Improper refractive correction. (2) Dirty contact lenses. (3) Cloudy solution. (4) Corneal edema. (5) Spasm of accommodation. (6) Clouding of the solution after insertion of lenses. (7) Meibomian-gland secretions on the anterior surface of the contact lenses. The first three causes for fogging can be eliminated by the ophthalmologist and the patient and will not be discussed here.

Corneal edema usually comes on from 30 minutes to four or more hours after the insertion of the contact lenses. It is due to the imbibition of the buffer solution by the corneal epithelium. The continued daily wearing of the contact lenses seems to toughen the corneal epithelium so that as time passes the patient can wear the contact lenses for longer and longer periods of time before fogging due to corneal edema begins. In some cases changing the strength or the formula of the buffer solutions will lengthen the time before fogging occurs.

Contact lenses, although well fitted, like any other foreign body in the conjunctival sac, induce stimuli which in turn produce undesirable reactions. Among these undesirable reactions is the spasm of accommodation noted in many cases, especially in the hyperopic patient when he first begins wearing contact lenses. This spasm of accommodation relaxes after a longer or shorter period of time as the eye becomes accustomed to the lenses.

In the same manner the contact lens acting as a foreign body stimulates the various paraocular glands. This at first thought would seem unimportant, but if we recall that the goblet cells are most numerous in the bulbar conjunctiva and that the scleral part of the contact lens acts as a funnel placed over the bulbar conjunctiva thus catching the mucous secreted by these glands, we can readily see how the stimulation of the goblet cells will cause the buffer solution to become cloudy due to the increased quantity of mucous. This, like the spasm of accommodation, decreases in most cases as the eye becomes accustomed to the presence of the contact lens.

The greasy secretion of the meibomian glands, essential as it is in preventing the tears from spilling over onto the cheeks and in sealing the eyelids during sleep, often proves to be the greatest problem with which the contact-lens wearer has to contend. In the first place the manipulation of the eyelids during the process of inserting the contact lenses, massages the secretion from these glands; then the contact lenses by their presence in the conjunctival sac reflexly stimulate the meibomian glands, as well as the other paraocular glands, and an excessive amount of this special sebum is produced. This increased sebum on the lid margins would be of no consequence if the anterior surface of the contact lens were wet so that it would repel the greasy meibomian-gland secretion. However, since the tears are a poor wetting agent, they do not wet the plastic contact lens. Thus, the meibomian-gland secretion is smeared onto the anterior surface of the contact lens producing a fogging of vision which is

very annoying to the contact-lens wearer.

In an effort to overcome this difficulty, patients have been instructed to place their contact lenses into one of a number of wetting agents with the hope that when the lenses are inserted the tears will wet them and prevent the smearing of meibomian-gland secretion over the anterior surface of the lenses. As wetting agents, these solutions have been very satisfactory. However, these solutions are irritating to the conjunctiva, and patients are instructed to rinse the contact lenses well with water after removing them from the wetting agent and before inserting them. By this procedure most, if not all, of the beneficial effect of the wetting agent is lost, and the patients continue to have fogging of vision due to sebum smeared over the anterior surface of the lenses.

A search has been made to find a wetting agent which would be tolerated by the conjunctiva so that some of the wetting agent might be left in contact with the lenses thus keeping the anterior surface of the contact lenses from becoming dry. To my knowledge, at the time of this writing, paratertiary-octyl-phenoxy-ethoxy-ethyl-dimethyl-benzyl ammonium chloride monohydrate (1:5,000) in a 2-percent boric-acid solution* is the only wetting agent that can be used without danger of producing an irritation.

The patient is instructed that when the contact lenses are removed, they are to be placed in a small, covered jar containing an ounce or so of wetting agent. The lenses should remain in this solution until the patient is ready to reinsert them. When the lenses are taken from the jar, the excess solution should be removed by a quick shake—not by rinsing. The contact lenses are inserted in the usual manner and, after the contact lenses are in place, the eyes are washed with an eyecup filled with the wetting agent. This procedure utilizes the detergent action of the wetting agent to wash away the excess meibomian gland secretion in addition to leaving a film of wetting agent over the anterior surface of the contact lenses. This helps to keep the lenses from becoming dry and repels any remaining sebum from the anterior lens surface.

441 Lowry Medical Arts Building (2).

* This preparation is a Parke, Davis and Company product sold under the name of Phemrol Ophthalmic.

REFRACTION CLINIC*

DISCUSSION BY

ALBERT E. SLOANE, M.D.†
Boston

A man, aged 39 years, noted three weeks earlier that he saw double unless he kept his head tipped and avoided looking to the left. He had never worn glasses before, and was not greatly inconvenienced by his present difficulties. Examination revealed vision to be: O.D., +1.00D. sph. ⊂ —0.50D. cyl. ax. 90°, 20/20; O.S., +1.00D. sph. ⊂ —0.50D. cyl. ax. 90°, 20/20.

Distance phoria test revealed: Distance —4Δ exophoria; phoria—8Δ right hyperphoria (O.D.), in the primary position.

Diagnosis was paresis of the left superior rectus muscle.

DISCUSSION

The symptoms of which this patient complained could be definitely attributed to a paresis of the left superior rectus muscle. This was substantiated clinically by his tendency to keep his head cocked back and to the left so that his eyes were directed for the most part down and to the right. The red-glass diplopia field gives us some very valuable information from a therapeutic standpoint. You will

* From the House Officers' Teaching Clinic, Massachusetts Eye and Ear Infirmary.

† Director of Department of Refraction.

note that there is quite a bit of exophoria manifested in the three upward positions of gaze. This is due to an anatomic divergence produced by the axis of the orbits when the eyes are in elevation. This is not due to any muscle weakness, because if a horizontal muscle were defective the horizontal imbalance would be greatest in one of the horizontal planes. When we consider the indications for prismatic correction, the diplopia field immediately tells us how much can be accepted without disturbance. The principal positions of gaze ordinarily used by a patient are the horizontal and the lower fields, and in these areas the minimum hyperphoria is 3 arc degrees, or approximately 6 prism diopters (1 arc degree equals 2 prism diopters approximately). Therefore, a prismatic correction up to 6 prism diopters will not introduce an opposite hypertropia. You will note that in the upper right position of gaze the vertical diplopia is smaller, 2 arc degrees or 4 prism diopters, but since one can easily avoid utilizing this field, it may be omitted from our consideration.

SOLUTION

Disturbing diplopias can be relieved by several measures: 1. Occlusion of one eye. 2. Prismatic lenses. 3. Surgery.

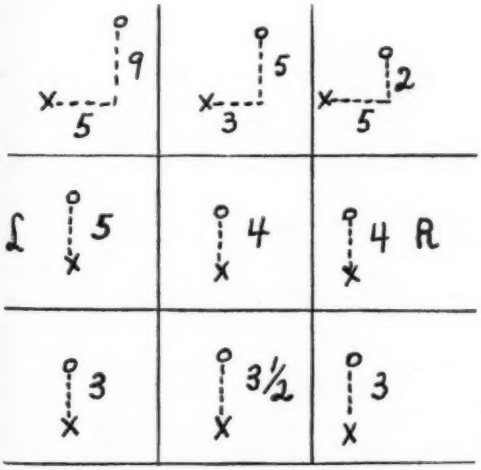


Fig. 1 (Sloane). Red-glass diplopia field plotted in arc degrees, x = O.D.; o = O.S.

In this instance, since the diplopia has never really been disturbing because the patient learned how to tip his head to minimize the difficulty, occlusion of one eye is not necessary. Glasses were prescribed for constant wear, which included: O.D., 2 prism diopters, base down; O.S., 2 prism diopters, base up. That is, 4 prism diopters of right hyperphoria correction were prescribed. He was told that he would still have to tip his head to neutralize the diplopia somewhat, since a partial correction only was given. It is best to prescribe, as a general rule, the smallest amount of prism that will obviate symptomatology. This has the further advantage of lasting the patient a longer time in a more suitable fashion as the paresis tends to diminish in amount. The patient was then referred for a complete medical and neurologic check-up, and all the findings were subsequently reported as negative. Glasses were prescribed as follows: O.D., +1.00D. sph. ⊃ —0.50D. cyl. ax. 90°, with a 2$^{\Delta}$ base down; O.S., +1.00D. sph. ⊃ —0.50D. cyl. ax. 90°, with a 2$^{\Delta}$ base up.

The patient reported back six months later at which time the diplopia field had not changed appreciably. The distance phoria readings in the primary position of gaze were as found at the first examination. The patient has been without symptoms and without diplopia and cannot get along without his glasses. He still can produce diplopia easily by looking to the left and up, but has developed a mannerism of keeping his head cocked in a compensatory way so that he never sees double, unless he looks for it.

QUESTIONS

House Officer: Once prisms are prescribed for a patient, does he always have to wear them?

Dr. Sloane: If the paresis clears up,

prisms will be rejected by the patient.

House Officer: Can you obtain this amount of prismatic effect by decentering the lenses?

Dr. Sloane: Displacement of 1 mm. in a 1-diopter lens will give 1/10 of a prism diopter prismatic effect, so obviously one cannot obtain sizable prismatic effects in weak lenses. In this case prisms were ground into the prescription.

House Officer: How can you tell the presence of a prism in a spectacle lens?

Dr. Sloane: There are three methods:

1. A difference in thickness of opposite edges of a lens would make you suspect a prism, but this would only hold true if the prisms were fairly strong.
2. The lensometer readings will be displaced from the center even though the lens is set in the instrument with its geometric center properly placed.
3. If you view a straight line through the geometric center and along the principal meridian of the lens, the line will not be continuous within and outside the lens, but will be displaced according to the power of the prism.

House Officer: If this man were presbyopic, how would you manage his glasses in bifocals?

Dr. Sloane: As a rule, any person who has to tip his head back over one shoulder cannot get along well with bifocals because he will look through different portions of each segment. Therefore it is advisable in such cases to avoid their use and to insist upon single vision glasses.

House Officer: Is it advisable to divide the prisms between both eyes or to incorporate them before one eye alone?

Dr. Sloane: Prisms ground into lenses make their cost greater, therefore, when it is possible we should correct the defect with prisms before one eye, but this is only effective if the total amount of prism power is not in excess of approximately 1½ prism diopters. The advantages of dividing prisms between two eyes are: (1) Both lenses weigh approximately the same so there is no tendency for the lens to hang lower on one side. (2) The spectacles are less conspicuous. (3) There is less chromatic aberration and other distortions which occur when one looks through strong prisms.

House Officer: When do you operate for the relief of diplopia in a paresis?

Dr. Sloane: There are two criteria. (1) If the amount of prismatic correction, in order to remove symptoms, is over 8 prism diopters, correction prisms are usually not satisfactory. (2) One should wait a certain period of time to allow the muscle to recover, if it is going to, and also to allow for secondary contractures which are likely to be the case, so that one can better judge what type and how much surgery should be done.

House Officer: How long is this time?

Dr. Sloane: Most persons agree that six months is a fair waiting period.

House Officer: In this case, if surgery had to be done, which muscle and what procedure would be indicated?

Dr. Sloane: Probably a weakening operation on the yoked muscle of the opposite eye. In this case a myectomy of the right inferior oblique muscle.

House Officer: What is the rational for selecting the right inferior oblique?

Dr. Sloane: Hering's law suggests that one must innervate yoked muscles alike. Thus a weakened right inferior oblique would require greater innervation, as does the paretic left superior oblique, thus tending to equalize their resultant activity and lessen the diplopia. Of course one can, theoretically, also do a strengthening operation to the left superior rectus for the same reason.

243 Charles Street (14).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 4, 1946

DR. BENJAMIN FRIEDMAN, *president*

CLINICAL ANATOMY OF VISUAL PATHWAYS

DR. MORRIS B. BENDER spoke on this subject during the instructional hour.

NEUROLOGIC LESIONS OF OPTIC PATHWAYS

DR. I. M. TARLOV described two cases of meningioma of the sphenoidal ridge. The first case was of a man who had been operated two years previously, and the second was of a woman who was operated four years previously. Proptosis was present in both cases and X-ray studies showed absorption of the sphenoidal ridge. Although both cases showed excellent results following operation, there was very little, if any, recession of the proptosis, which was marked in one case and slight in the other. The intraorbital, as well as the intracranial portions of the tumor, were removed in both cases.

Dr. Tarlov also presented a case of orbito-ethmoidal osteoma, which was operated. The sudden development of an intracranial, frontal pneumatocele in this patient was associated with a contralateral hemiplegia. This disappeared completely after removal of the osteoma, evacuation of the air within the frontal lobe, and repair of the dural defect in the floor of the anterior fossa with fascia lata graft. Other orbital tumors were discussed and an X-ray picture of a calcified orbital meningioma was shown. Dr. Tarlov concluded by pointing out the advantages of the transfrontal approach for orbital tumors, many of which have intracranial extensions.

Discussion. Dr. Alfred Kestenbaum stated that there are three types of meningioma which are of importance to the ophthalmologist:

1. Meningioma of the olfactory groove. This is the most frequent but not the only cause of the Foster-Kennedy syndrome.

2. Suprasellar meningioma. Suprasellar tumors may result in bitemporal hemianopia which sometimes starts as a bitemporal hemianopia central scotoma. The nasal half of the macular area of the field is always preserved.

3. Meningioma of the sphenoid ridge. This condition may show an ophthalmic syndrome, which if fully developed consists of the following signs: (a) Symmetrical exophthalmos—exophthalmos without lateral or vertical displacement of the eye, as is often seen in orbital tumors close to the eye. (b) Negative resistance-sign—the eye can be pressed backward as normal; whereas, in tumors immediately behind the eye, a hard resistance is felt. (c) Eye-muscle palsies—may be due to either a lesion of the nerves or to a direct pressure on the muscles. (d) Retrobulbar lesion of the optic nerve caused by pressure—may produce a central scotoma and temporal pallor, and later total blindness and total "descending optic atrophy" of the disc. (e) Disturbances of the pupillary reactions—depending upon the damage to the optic nerve.

Aneurysms of the brain arteries have become of great importance to the ophthalmologist in recent years. The following types are of special interest:

1. Arteriovenous aneurysm of the carotid artery in the cavernous sinus. This causes the well-known picture of pulsating exophthalmos.

2. Simple aneurysm of the carotid artery in the cavernous sinus without arteriovenous communication. It may be the cause of eye-muscle paresis but there is neither exophthalmos nor pressure on the orbital part of the optic nerve.

3. Aneurysm of the carotid artery after it passes through the dura and arachnoid within the subarachnoid space. In this case the visual field changes may become manifest in two forms because the carotid lies laterally to the chiasm: (a) Pressure on the chiasm from the side may result in a nasal defect in the field of one eye (not a binasal defect). (b) Pressure of a big aneurysm of the right carotid artery upon the right optic nerve, as well as upon the right optic tract, may result in a combination of left-sided hemianopia and loss of the macular vision in the right eye.

4. Aneurysm of one of the anterior arteries of the circle of Willis. The anterior cerebral and anterior communicating arteries may cause pressure on the chiasm from in front and above and at the same time on one optic nerve. In this case the visual field will show bitemporal hemianopia and loss of the macular area of the eye homolateral to the aneurysm.

5. Aneurysm of the posterior part of the circle of Willis (as of a posterior communication or of a posterior cerebral artery) often affects the oculomotor nerve. In recent years it was emphasized that isolated palsy of the oculomotor without any other signs should arouse the suspicion of such an aneurysm.

Field changes in pituitary syndromes

Dr. Daniel Kravitz stated that to the average ophthalmologist, field changes in the pituitary region means bitemporal field defects. However, in no other part of the brain are the field changes so varied and so difficult to interpret. It is only in this region that one can get blindness in one eye or both, binasal or bitemporal defects, homonymous hemianopias, central scotomas, and all manners of combinations of these. For a proper understanding and interpretation of these variations, Dr. Kravitz stressed the need for a knowledge of the anatomy, embryology, and physiology of this region.

Dr. Kravitz concluded that to wait for the typical field changes before making a diagnosis would frequently end in tragedy. Therefore, some knowledge of the anatomy and physiology of those parts of the brain which may affect visual pathways is essential.

Discussion. Dr. Thomas H. Johnson opened the discussion by saying that the variation in the visual fields is due to the relation of the chiasm to the surrounding structure. Walker and Cushing found in a series of 183 cases of pituitary tumor that 148 cases showed field disturbance. Bitemporal hemianopia was present in 47 cases, homonymous in 22 cases; 79 patients were blind in one eye, and the type of hemianopia could not be determined. De Schweinitz found homonymous field defects in 6 percent of his cases, and Hirsch in 7 percent. The tumors may not grow symmetrically, but may encroach more upon the structures of one side than the other. In a study by Schaeffer, it was found that the chiasm may lie in front of, directly over, or behind the pituitary.

In about three fourths of the specimens, the anterior and often the greater part of the chiasm rests on the sella diaphragm. At times there may be a vertical space of 10 mm. between the pituitary and the chiasm. It is obvious that neoplasms, having their origin in tissues beneath the chiasm, give early defects in the upper temporal quadrants; while those arising from tissues above the chiasm show defects in the lower temporal quadrants.

Before any of the changes produced by pressure manifest themselves, however, scotomas may be present. The most com-

mon location of the scotomas is in the cecocentral area, not uncommonly in the lower temporal quadrants but rarely in the nasal half of the field. They are prone to be bilateral. These scotomas progressively widen into quadrant defects and hemianopias.

De Schweinitz supports the theory of Fuchs, that they are caused by toxins, thrown off from the neoplastic tissues into the cerebrospinal fluid in the cisterna chiasmatica, which bring about a retrobulbar neuritis.

Walker and Cushing think scotomas of this character can not be explained on a mechanical basis alone, and that an explanation based on hypersensitiveness of the papulomacular bundle, or toxic actions, is unsatisfactory but must be accepted in the light of our present knowledge. They believe that pressure upon the chiasm from the tumor alone does not account for all of the field changes, but that traction and tension upon the crossed fibers, and counterpressure from the anterior clinoid processes, dural bands, and the bony walls of the optic foramen, are important factors, as well as pressure on the tracts farther back against the peduncles. They report, on the other hand, a case in which pressure by the neoplasm had greatly displaced one of the optic tracts, without producing any change in the visual fields or optic discs.

Fay and Grant reported a case of pituitary tumor which pressed the chiasm against the anterior cerebral artery, causing the artery to indent the optic tract and thus produce an homonymous hemianopia.

Traquair's hypothesis is that field defects in chiasmal lesions are due to pressure, traction, and the action of toxins; that the pressure does not produce the changes by direct action upon the chiasm but by impeding venous return and producing arterial ischemia. He thinks the scotomas indicate activity of tumor growth.

It is a common belief that the maculopapular bundle is very susceptible to the effects of toxins, and the toxin theory regarding production of scotomas is probably acceptable to most ophthalmologists. A bilateral scotoma in the visual fields, a scotoma in one field and slight upper or lower temporal defect in the other, or a slight bilateral upper or lower temporal defect should put one on guard against a lesion of the chiasm.

As the optic atrophy is a descending one, the disc may not become pale until the hemianopia has been in existence for some time. As a rule the nerve head is a pink, waxy color. The disc outline is more often than not blurred by a deposit of connective tissue; as is the lamina cribosa.

Internal hydrocephalus may distend the third ventricle to such a degree as to press upon the chiasm, erode the bony structure around the sella, and bring about a hemianopia. Dr. Johnson said that he had had such a case in a 9-year-old boy. These cases, he said, showed a papilledema rather than a pale optic-nerve head. He also spoke of a case in which an aneurism of the circle of Willis simulated a pituitary neoplasm. All verified recorded cases of such aneurisms have had a paralysis of the third nerve.

Gliomas of the chiasm produce very irregular and early field defects, may show an enlargement of the optic foramen, and may be accompanied by a more or less general neurofibromatosis. Dr. Johnson concluded his discussion by remarking that, since most lesions which produce the chiasmal syndromes erode the clinoid processes or widen and distort the cells, careful X-ray studies by a skilled roentgenologist will clarify the diagnosis.

Dr. Bender said that in the neurologic clinics of Bellevue and Mount Sinai Hospitals, they are not able to make exact

localization as to whether the lesion is above or below. In some cases, autopsy reveals tremendous tumors near the chiasm with no visual-field defects; in others, there is tumor depression of the entire chiasm. Dr. Bender said that it was not possible to determine whether the tumor was anterior, posterior, or lateral.

Dr. Alfred Kestenbaum said that the two terms—bitemporal hemianopic central scotoma and true central scotoma—must be sharply separated from each other.

Because the fibers originating from the nasal halves of the two maculas cross the midline in the most posterior part of the chiasm, involvement of the chiasm from behind, that is by a suprasellar tumor, may cause a bitemporal hemianopic central scotoma. In each field the nasal half of the macular area is damaged; whereas, the temporal half is preserved. In other words, there is "macular splitting." Visual acuity may still be 20/20. Completely different from this picture is the real central scotoma, as it is seen in cases of pressure on, or in disease of, the optic nerve. Here the temporal as well as the nasal half of the macular area is involved. The vision may be diminished down to eccentric vision of fingercounting at two meters. When the focus involves the chiasm from above, the field defects start in the inferior quadrants. When the focus involves the chiasm from below, the field defects start in the superior quadrants. If the focus involves the chiasm from in front, an optic nerve must be involved also, resulting in a central scotoma of that eye. If the focus involves the chiasm from behind, there cannot be a real central scotoma, for the nasal halves of both macular areas must be preserved.

The combination of these rules permits a certain degree of accuracy in the localizing of these lesions. Dr. Kestenbaum concluded by remarking that the final diagnosis has to be made by the neurologist in conjunction with all other neurologic symptoms.

Dr. Kravitz (in closing) remarked that he agreed with Dr. Kestenbaum that experience in taking visual fields in brain tumors is very important. He said that tumors pressing on the chiasm far in front or in the back will show that anatomists are correct. The anatomic arrangement is important. All optic chiasms are not the same, nor are all optic nerves. Some are fixed by dura, some are short and some are long. If the chiasm is fixed, then early symptoms appear; if mobile, they take a great deal before showing defects. In general, there is confusion due to various anatomical changes and variations within the skull.

Bernard Kronenberg,
Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

October 24, 1946

Dr. Burton Chance, *chairman*

Adenocarcinoma of lacrimal gland

Dr. I. Edward Rubin (by invitation) presented a case of mixed tumor of the lacrimal gland, which is rare, there being less than 300 cases reported in the literature. Although it is the commonest disease of the lacrimal gland, the origin of this tumor is still a controversial subject. Grossly and histologically it resembles a mixed tumor of the salivary gland.

The signs and symptoms of mixed tumor of the lacrimal gland are those of a slowly progressive, unilateral, orbital tumor. These include proptosis with displacement of the globe downward and slightly nasalward. A mass felt in the

region of the lacrimal gland is a constant, diagnostic sign. There is also limitation of motion, diplopia, impairment of vision, fundus changes, usually no pain, lacrimation, and exposure keratitis.

Recurrence of this tumor frequently occurs. It is often incompletely removed, and has a strong tendency toward bony invasion. It may become malignant after many years.

X-ray therapy has little noticeable effect. Surgical removal is the best treatment, and should be as radical as possible. If bone is involved, it should be resected. If the orbital tissues are involved, an immediate exenteration is indicated. Four surgical approaches were discussed: the direct, the transconjunctival, the Kronlein, and the frontal flap with removal of the roof of the orbit.

A case of mixed tumor of the lacrimal gland in a white man, aged 35 years, was presented. The case had been followed from childhood. When the patient was 10 years of age, proptosis was first noted. At the age of 16 years, a mixed tumor of the left lacrimal gland was supposedly completely excised. After 11 years, the tumor first recurred. It was again excised five years later when the patient was 33 years of age. Microscopically, the tumor was reported as a mixed tumor. Within 21 months it recurred, and this time it involved the optic nerve producing papilledema. Intracranial extension was suspected, so a frontal craniotomy with removal of the roof of the orbit was performed. This was followed by a complete exenteration of the orbit. A large tumor, apparently arising from the region of the lacrimal gland, extended posteriorly to compress the optic nerve. Pathologically, the tumor tissue was adenocarcinomatous.

In conclusion, Dr. Rubin thanked Dr. Spaeth for the privilege of presenting this very interesting and unusual case. He also acknowledged to Dr. Zentmayer that this was a follow-up on the case he had reported 18 years ago, and thanked him for his coöperation.

Discussion. Dr. Jacob H. Vastine, 2nd, said that Dr. Rubin had made such a complete presentation of this subject that little remained to be discussed.

Surgery is probably the treatment of choice in cases of mixed tumors, whether of the salivary glands, nasal accessory sinuses, or lacrimal glands. In some cases, surgery is impossible or refused, and in these cases irradiation has value. This may be administered either as X-ray therapy, radium therapy, or both. The irradiation may be expected to effect regression of malignant tissue, and to retard the growth of the benign elements. There is sufficient proof of the value of irradiation to recommend it as a postoperative measure.

It is interesting to note that this patient was first operated upon in 1927. He received immediate postoperative X-ray therapy, administered by Dr. Henry Pancoast, and did not have a recurrence for 11 years. He was treated by me in 1939 and 1940, and the tumor remained quite stationary until 1944. He was again operated upon in 1944, and at that time received no postoperative roentgen therapy. It is quite striking that there was a rapid recurrence, and within two years another tumor was removed from the same site. This time it was malignant. The question may be asked whether postoperative treatment in 1944 would have delayed recurrence or malignant change. X-ray studies, made by me in 1939 and again in 1946, showed a pressure erosion of the roof of the orbit in the region of the lacrimal fossa. This defect remained unchanged.

Roentgenograms and photographs were presented of an unconfirmed case treated by Dr. Pfahler and me, in 1930. There was marked ptosis and proptosis which regressed following roentgen therapy

alone. The patient had been studied by Dr. Goalwine in New York, in 1930, at which time a defect in the lacrimal fossa of the orbit was found. This was similar to that in the case presented by Dr. Rubin. That patient was referred to Dr. Pfahler for roentgen therapy in 1930. A presumptive diagnosis of a mixed tumor of the lacrimal gland was made. Roentgen therapy alone was administered by Dr. Pfahler and by me. The patient was entirely well when last seen five years later.

Dr. Robert A. Groff congratulated Dr. Rubin on his excellent presentation and said that it was not only interestingly told, but also covered the subject thoroughly.

Prior to operation of the patient who constitutes the case report in the author's paper, it was thought that the orbital tumor had entered the orbit through the bony defect in the orbital roof, as seen in the X-ray pictures, or that it had extended along the optic nerve into the cranial cavity. When the anterior fossa was explored, there was no evidence of tumor. Upon removing the roof of the orbit, it was quite obvious that the tumor had extended throughout the tissue in the orbit, and it was difficult to identify normal structures. For this reason, he had contented himself with excising part of the tumor with the idea that Dr. Spaeth, at a later date, should remove the entire contents of the orbit.

The procedure of frontal craniotomy and removing the roof of the orbit is very simple and safe. It is done entirely extradurally so that the subdural and subarachnoid spaces are not entered nor contaminated. The exposure it affords of the structures in the orbit is excellent. It is recommended not only as an easier method to remove orbital tumors completely, but also as the procedure for decompression in exophthalmos. The procedure should be done jointly by the neurosurgeon and the ophthalmologist.

Dr. Edmund B. Spaeth (in closing) said that as soon as the report of the biopsy from Dr. Groff's transfrontal operation had been received, a radical exenteration of the orbit had been done. The reason for the massive and immediate postoperative radium therapy was not because there originally had been a mixed-cell tumor, but because a clean, clear-cut, rapidly developing adenocarcinoma was reported.

One other case of mixed-cell tumor of the lacrimal gland is under observation, and we are wondering with this occurrence what is going to happen to that case. The case was operated, using the Kronlein technique, and received X-ray therapy in massive doses postoperatively. The report we received at the time of the surgery, after examination of a frozen section, was mixed-cell sarcoma. That is why we proceeded with massive X-ray therapy. Forty-eight hours later, a second report changed the diagnosis to mixed cell tumor. I am rather curious to know what is going to happen to this young lady. She has a practically complete ptosis following surgery, and declines surgery for this ptosis. I am not urging her. I would much prefer to let that alone for the time being. She is developing a sequestrum in the lateral wall of the orbit, and I would not be at all surprised if it becomes necessary to perform a sequestrectomy of that area of the zygoma.

Periarteritis nodosa

Fred Harbert, Capt. (MC), U.S.N. and Samuel D. McPherson, Jr., Lieut. (jg), (MC), U.S.N.R. (by invitation) presented a case of scleral necrosis in periarteritis nodosa which was published in the June, 1947, issue of the Journal on page 727.

Hydration and transparency of cornea

William M. Hart, Ph.D. (by invitation) said that recent work (Cogan and Kinsey, *Science*, 1942, volume 95, pages

607-608) has emphasized the degree of hydration as the chief determining factor in transparency of the cornea and as responsible for the optical difference between cornea and sclera. According to this concept, the cornea is endowed with a dehydrating mechanism to keep down its water content. When this mechanism fails, swelling occurs and, therefore, opacification. The sclera, on the other hand, is always opaque, because of the absence of any such mechanism. If, however, the sclera is deliberately dehydrated, as by drying in air or placing in glycerine, it also becomes "transparent."

In the present study, swelling and transparency of beef corneas were noted in various buffer solutions, all of which were adjusted to the same osmotic activity (8.94 atmospheres) by adding glucose. Throughout this study an absolute disparity was found between the degree of hydration and the turbidity of the cornea.

The cornea may be characterized as a lyophilic colloid system inasmuch as it shows behavior analogous to gelatin and fibrin under like conditions. Like many specimens of gelatin, it has an isoelectric point of pH 4.6 as shown by the swelling minimum.

Various factors were found to affect the transparency of the cornea independently of the water content. It is suggested that these factors operate by affecting the refractive index of the water or of the micelles, or both.

Affecting the micellar refractive index are: (1) temperature, (2) electrolytes, (3) isoelectric point, (4) dissociation, (5) association, (6) mechanical stresses (as in birefringence), (7) pH, (8) hysteresis, and (9) coacervate formation (due to protein-lipid-carbohydrate complexes).

Affecting the refractive index of the water are: (1) pH, (2) electrolytes, (3) nonelectrolytes, (4) surface tension, and (5) temperature.

According to this theory, when the refractive index of the solvent water in the cornea becomes markedly different from that of the particles, turbidity results.

The practical potentialities of these observations were shown in the fact that it was possible to clear the corneal opacities which occur spontaneously in cattle. Further work will be directed toward such an attempt in the intact animal.

Discussion. Dr. Francis Heed Adler said that it would be very difficult for anyone to discuss this paper after hearing it for the first time, and it was quite impossible for him to do so, but he could not refrain from mentioning how delighted he was that work of this type was being done in Philadelphia. The results of investigations of this character do not remain long in the laboratory. They have definite practical significance.

A few years ago, Cogan in Boston, and others, began experiments on the permeability of the cornea and its property of imbibition, which are being applied in the clinic. They showed the the normal cornea soon becomes less transparent if bathed with a solution of ordinary normal salt or with hypotonic solution. In order to keep the cornea clear during an operative procedure, such as detachment of the retina, most surgeons now keep the cornea flushed with a salt solution of 1.5-percent strength. They also showed that most of the deleterious effect of cocaine solutions was due to the fact that they are hypotonic. The question of turbidity of the cornea with loss of its transparency becomes increasingly important with the operation of transplantation of the cornea.

For the last few years, Dr. Leopold has been interested in transplanting corneas from frozen dried material. Although these transplants take well, they soon become opaque and remain so. The answer to this problem is to be found in the kind of work which Dr. Hart is doing, and I trust that he will be encouraged to continue it.

Dr. William M. Hart (in closing) thanked Dr. Adler for his comment and said that, as shown in the data, the dehydrated cornea, when rehydrated, is often optically better than normal cornea. He and his co-workers were not aware of Dr. Leopold's work, of course, which was carried on under conditions of war secrecy, but the next point they had in mind was to try to transplant corneas from the dried state.

Opacity of the cornea is a very common condition in cattle. A number of such eyes were brought to the laboratory. Some of them had deep ulcer craters, which he presumed to be scar tissue. Such corneas can be cleared in one of two ways. They can be dried in air, in which case they become clear as normal corneas; or, they can be allowed to swell in appropriate strength hydrochloric acid or various buffer solutions. Those corneas which have been dried may be rehydrated and then do not again become opaque.

George F. J. Kelly,
Clerk.

CHICAGO OPHTHALMOLOGICAL SOCIETY

DR. WILLIAM A. MANN, *president*

October 17, 1946

CLINICAL PROGRAM

The clinical meeting was presented by the Department of Ophthalmology, University of Chicago.

BOECK'S SARCOID DISEASE

DR. BYRON L. GIFFORD presented two cases of this disease.

Case 1. Mrs. D. R., aged 36 years, was first seen in July, 1946, with a history of pain and redness in the right eye in September, 1945, followed by remission, and exacerbation of redness in April, 1946, with concurrent redness of the left eye. At another clinic, a biopsy of a cervical lymph node had been made, chest films had been taken, and a diagnosis of sarcoid disease was made.

Aided vision was: R.E., 20/70; L.E., 20/30. Both eyes showed seroplastic uveitis without nodules. There was a heavy increase in aqueous flare with low cell count (2 to 3 per smallest slitlamp field), very large mutton-fat keratic precipitates deposited on the corneal endothelium, many heavy posterior synechiae, and an uveal pigment and cyclitic membrane on the lens capsule. The right eye showed more involvement than the left. The right fundus showed a red reflex only; in the left fundus, detail was blurred, but no pathologic condition was noted.

In August there was increased reaction in both eyes; vision decreased to: R.E., 20/300; L.E., 20/100. Two months later both eyes showed rather remarkable beginning spontaneous remission, especially the left eye in which aqueous-flare increase was minimal, with only an occasional floater, and marked decrease in the number of keratic precipitates. At this time vision was: R.E., remained 20/100; L.E., returned to 20/30+.

Only a single lymph nodule was found in the axilla. X-ray pictures of the chest showed large round hilar masses bilaterally with absence of parenchymatous lesions; no sarcoid rarefactions were noted in X-ray studies of hands and feet. Tuberculin sensitization, skin tests for lymphogranuloma, serology tests all gave negative findings.

Case 2. Mrs. J. J., aged 25 years, first noted a growth in her left eye in December, 1945. Prior to that time she had had a "nervous breakdown," with general weakness, marked tremor, and weight loss, without cough or elevation of temperature. A chest film taken in 1944 was

reported as negative. Her mother supposedly died from tuberculous infection.

When seen in March, 1946, the corrected vision was: R.E., 20/16; L.E., 20/100. The left eye showed a large, yellowish-pink, slightly lobulated tumor mass filling about one third of the anterior chamber from the inferior nasal limbus to the pupil and pressing against the cornea. This was seen to be attached to the iris and was covered with a fine network of vessels, all originating from the iris. The aqueous flare was increased. There were occasional floaters and many large mutton-fat keratic precipitates on the corneal endothelium. The 2-mm. pupil was fixed to the lens, which showed a complicated cortical cataract. No fundus details were seen.

In the right eye, the cornea was clear, with no increase in aqueous flare, no floaters, and no keratic precipitates. The iris showed two tiny bulges, about 1 mm. in size, near the limbus and at the pupillary margin. The pigment border of the pupil was slightly irregular with no frank pigment exfoliation.

During subsequent weeks, a sarcoid uveitis in the right eye was observed under the slitlamp, from the early incipient stage to a full-blown nodular and seroplastic type. The pupil border became stringy, the iris stroma appeared swollen, aqueous flare gradually increased, a few floaters appeared, and within five weeks, the tiny bulges of the iris pigment layer became typical Koeppe nodules. Abundant mutton-fat keratic precipitates were deposited on the corneal endothelium. More Koeppe nodules formed at the pupillary border, from which site posterior synechiae developed.

The skin of the flexor surface of both forearms showed many small subcutaneous nodules. X-ray pictures of the chest showed extensive infiltration at each hilus, along the mediastinum and in both upper lobes, compatible with sarcoidosis. X-ray films of feet and hands showed no rarefaction. Routine serology and other laboratory and skin tests gave negative reactions. Biopsy of one of the subcutaneous nodules of the arm showed, on microscopic section, a mass of highly vascularized granulation tissue in which epithelioid cells were occasionally arranged to form tuberculoid structures with Langhan's type giant cells; no caseation necrosis was seen.

X-ray therapy to the tumor mass of the left eye was given at weekly intervals. At the end of the fourth week, the tumor mass appeared to shrink in size about 20 percent, but regained its original size during the remainder of 10 treatments.

When the patient was last seen in August, 1946, the vision of the right eye remained 20/13, but vision of the left eye was reduced to hand movements at two feet. Tension remained within normal limits during the time of observation.

Toxoplasmosis

Dr. Byron L. Gifford said that A. P., a man, aged 38 years, was seen in September, 1946, with a history of poor vision in both eyes since childhood. The left eye had always been the better until five years ago, when vision gradually decreased until there was no light perception in this eye. Vision was: R.E., 9/200.

The right eye showed myopia of 3 diopters, a large macular chorioretinal coloboma, degenerative papulomacular bundle, temporal optic atrophy, anomalous retinal correspondence, at least 10 degrees nasalward and 10 degrees below the posterior pole. The left eye showed a microcornea (R.E., 11.5 mm., L.E., 9.5 mm.), iris rubeosis, blockage of angle of anterior chamber by the adherent iris root, and a bizarre complicated cataract with white, sculptured, statuelike opacity. The fundus showed an enormous posterior staphy-

loma. The eye was glaucomatous (Schiøtz, R.E., 22 mm. Hg; L.E., 54 mm.). All laboratory tests were negative.

In spite of the lack of history of the sequence of events, the findings would indicate an early, possible fetal infection, leading to the numerous present complications. Tests will be made to confirm the diagnosis of plasmosis.

Bilateral retrolental fibroplasia

Dr. Barbara Spiro presented a case of retrolental fibroplasia with fetal iritis and secondary glaucoma.

Case report. D. M., a white baby girl, aged 1½ years, was first seen in February, 1946. The baby and her twin brother were born after a 6½ months uneventful pregnancy; the boy died shortly after birth. The mother noted the girl's poor vision at the age of 3 or 4 months.

There was questionable light perception in each eye, the left apparently the better one. Bilateral enophthalmos and epicanthus were noted. The eyes exhibited bilateral searching nystagmus. The right cornea measured 8.5 mm., with central opacities; the left, 9 mm. Both anterior chambers were very shallow. Both irides were of fetal-blue color, atrophic and with vessel formation. Whitish nodules were noticed at the iris frill. The iris was bound down by extensive synechiae with a 2-mm. pupil; the left pupil could be dilated to 5 mm. The lenses were fairly clear and behind each one could be seen a whitish-gray mass with small blood vessels on the surface. On the left side, a few fundus vessels and a grayish-red reflex could be made out; on the right, nothing beyond the gray mass. Ocular tension with Schiøtz and Souter tenometer was about 30 mm. Hg on the right and 15 mm. on the left.

Pediatric examination showed the baby to be normal otherwise, although some mental retardation was noted.

Bilateral rubeosis irides

Dr. Barbara Spiro said that D. P., a 49-year-old white man, was shown before this society in May, 1945. At that time he stated that his vision had started to diminish two years before. He had diabetes mellitus which was controlled with diet and insulin. Vision was: R.E., 20/100; L.E., 8/200. The striking findings were bilateral iris atrophy with rubeosis irides of the left eye, advanced diabetic retinopathy of both eyes, and rete mirabile of the right eye. Since that time the patient has been under good medical care. Vision has continued to decrease to hand movements at two feet in the right eye, and light perception in the left. He now has bilateral rubeosis irides, the retinopathies have become more marked, and he has bilateral rete mirable.

Bilateral retrolental fibroplasia

Dr. Barbara Spiro presented R. S., a 6-months-old white boy, first seen in September, 1946. He was born 2½ months prematurely after an uneventful pregnancy. The poor vision was noted at the age of 2½ months.

Examination revealed bilateral sunken eyes and bilateral nystagmoid ocular movements. The corneas were clear and measured 9 mm., horizontally. Both anterior chambers were extremely shallow. The irides were fetal blue in color, the pupils could be dilated to 3.5 mm., and the irides were bound down with numerous posterior synechiae. Some anterior synechiae were seen peripherally. The lenses were clear. Behind them were large whitish-gray masses, extending into and including the retinas. A red fundus reflex could be obtained in the periphery.

No other abnormal physical findings were noted. The psychologist reported a dull rating, but was optimistic concerning the child's development compared to that of similar premature blind babies.

Retinitis pigmentosa sine pigmento

Dr. S. J. Alexander said that this 31-year-old white man complained of poor night vision of 15 years' duration. Vision was: R.E., 20/16−2; L.E., 20/13−2. Examination revealed normal external eyes and normal anterior segments.

The fundi showed essentially normal discs, reduction in size of the vessels, and a very few small pigment clumps in the periphery. The retina had a slightly pale-gray, granular appearance. Visual fields revealed bilateral ring scotomas.

On questioning, the patient said he knew of no other similar eye difficulty in the family. However, his mother was examined a few days later and identical eye findings were seen.

Optic atrophy, retrobulbar neuritis, and brucellosis

Dr. S. J. Alexander presented C. S., a 22-year-old ex-marine, who complained of sudden loss of vision in the right eye one month previously. Several days later vision had returned to light perception, which did not improve. A tentative diagnosis of brucellosis was made because of a rather constant, low-grade fever, enlarged lymph nodes and spleen, and previous questionable blood cultures for Brucella.

Vision was: R.E., light perception and projection temporally only; L.E., 20/20+2. A right divergent strabismus was found. The adnexa and anterior segment were normal. The right pupil reacted weakly to light but well consensually; the left reacted well to light but poorly consensually, normally for accommodation. Examination of the fundi showed the right disc to be white and slightly elevated with blurred margins. The left disc was normal. The veins showed marked congestion, tortuosity, and segmentation. Arteries were tortuous and somewhat reduced in size. A few minute striate hemorrhages were noted. The right foveolar reflex was absent. The left macula was normal. There was slight edema of both retinas.

To confirm the diagnosis of brucellosis, a lymph-node biopsy was taken. The section showed lymphoid lipoidosis of the Hand-Schüller-Christian type. The ophthalmologist, however, could only say that this was an aberrant form of optic atrophy.

Optic atrophy with arachnoiditis

Dr. A. W. Feldman presented J. F. K., a white woman, aged 45 years, with a history of hypertension of 10 years' duration and various complications for which she had been under medical and surgical treatment since that time. An examination in April, 1946, disclosed papilledema with pallor of both discs and sluggish pupillary reflexes. In December, 1945, she had fallen, sustaining a Colles' fracture and a contusion over the right eye.

Ophthalmic examination in August, 1946, showed no light perception in either eye. Blood pressure was 242/130 mm. Hg. The pupils measured 5 mm. and were fixed. An irregular searching nystagmus was present. The discs were pale gray and showed 2 diopters of papilledema. There was peripapillary and perimacular edema bilaterally, but the maculas were not remarkable. The vessels showed irregularity of lumen size. The arteries were markedly sclerotic, some being of silver-wire variety, and the A.V. ratio was about 1:3. There were no hemorrhages or exudates.

Lumbar puncture revealed spinal-fluid pressure of 350 mm. which rose to 550 mm. with jugular pressure. The fluid was clear, and the Pandy test was negative. X-ray films revealed normal optic foramina. Subsequent ventriculography showed the ventricular system to be in

the midline and moderately dilated, with no apparent cause for dilation. Because of the history of injury, findings of bilateral optic atrophy, and increased intracranial pressure, with absence of X-ray or clinical evidence of intracranial neoplasm, a diagnosis of chronic arachnoiditis was made. A subtemporal decompression was performed in September, 1946, at which time it was noted that the arachnoid was grayish and thickened along the vessels of the cortex; elsewhere, it appeared essentially normal. Postoperative lumbar punctures were done daily and then every two days. She was free from headache when discharged to be followed in the neurosurgical outpatient department.

Familial retinal hypoplasia with nystagmus

Dr. A. W. Feldman presented four patients with familial retinal hypoplasia with nystagmus because of the findings in a father and three children.

Case 1. R. T., a white man, aged 38 years, gave a history of poor vision for as long as he could remember. He had first worn glasses at the age of 10 years. His father and three siblings were myopic. There was no family history of night blindness. Vision was: R.E., 20/70; L.E., 20/100. The right vision could be corrected to 20/30; the left was unchanged. Examination revealed a right divergent squint of 10 degrees, a coarse horizontal nystagmus, and normal anterior segments. The fundi showed bilateral thinning of the retinas and normal discs, vessels, and maculas. Bjerrum fields were within normal limits.

Case 2. The son, aged eight years, had worn glasses since the age of four years. Vision was: R.E., 20/50−2; L.E., 20/70+1; corrected to 20/50−2 in each eye. There was an alternating convergence of 10 degrees with preference for right-eye fixation and a coarse nystagmus. The fundi showed the retinal thinning noted in the father's eyes.

Case 3. A five-year-old daughter had never worn glasses but her parents had noted poor vision and nystagmus. Vision was: R.E., 20/100; L.E., 20/70−1. There was an alternating convergence of 15 degrees with preference for left eye fixation, coarse nystagmus, and retinal thinning bilaterally.

Case 4. Another daughter seen one year later at the age of eight years had worn glasses for three years. Vision was 20/40−2 in each eye, improved with correction to 20/40+3 in the right eye, and 20/50−2 in the left eye. There was an alternating convergence of 15 degrees with preference for left-eye fixation. The same type of nystagmus and bilateral retinal thinning was noted.

Von Recklinghausen's disease

Dr. Paul G. Wolff presented H. F., a 30-year-old white man, who was seen in consultation with the Surgery Clinic following plastic repair of the left temporal area. He was born with a mass of neurofibromatosis of the left side of the head.

Examination showed an extensive soft-tissue lesion of the left side of the head from the orbit to the occiput, with underlying bony changes, left optic atrophy, right and left gray choroidal lesions interpreted as fibromata, numerous small nodules of right and left irides, increased visability of the corneal nerves, café-au-lait spots, and small soft painless nodules of the skin. The movement of the proptosed and grossly displaced left globe was disturbed and caused occasional diplopia in spite of the low (6/200) acuity. The patient's I.Q. was seemingly normal. No information of value as to heredity factors was available.

Groenblad-Strandberg syndrome

Dr. C. Keith Barnes said that J. B., a 46-year-old white man, gave a history

of intraocular hemorrhages for 23 years. The patient stated that he bruised easily and that his dentist had always been uneasy about his bleeding.

Examination disclosed a classical picture of Groenblad-Strandberg syndrome. There were extensive angioid streaks of both fundi; extensive central chorioretinal scarring with macular involvement from resorbed choroidal hemorrhages, extensive pseudoxanthoma elasticum of the neck, axillae, cubital fossae, abdomen, inguinal areas, and rhomboidal fossae. The corneal microscope showed irregularities and sacculations of the subconjunctival arteries. Skin biopsy showed degeneration of the elastic tissue. The laboratory studies were negative except for a bleeding time of 4.5 minutes and a strongly positive intradermal test with brucellergin.

Right and left tetany cataracts

Dr. C. Keith Barnes said that the above diagnosis was made eight years ago when H. W., a 32-year-old man, was first seen. He gave a history of convulsions in infancy, but did not have any details. No definite evidence of parathyroid deficiency was established. The basal-metabolism rate was rather low. Blood chemistry was within normal limits.

On examination, symmetrical opacities of the lens of the right and left eyes were seen. These were of classical appearance. They were uniform, translucent, ghostlike shells of punctate opacities, surrounded by clear cortex and completely surrounding clear nuclei.

Retinal atrophy with macular degeneration

Dr. F. S. Ryerson said that B. W., a man, aged 36 years, complained of loss of central vision. Over a period of 12 months, beginning in 1944, his ability to read, recognize people, and judge targets steadily decreased. He was discharged from the Army with the diagnosis of bilateral macular degeneration. He could read newspaper headlines and could recognize people only within a short distance. He had noticed only slight loss of color perception. Examination at the age of 27 years was said to have shown good vision. He said the funduscopic examination was negative.

The patient had 15 brothers and sisters. Of these, two brothers and one sister had developed the same symptoms. One other brother and two other sisters had ocular deficiencies of undetermined nature. The other siblings and the parents apparently had no ocular defects. Three cousins had serious ocular defects.

The patient had visual acuity of 20/200 in each eye. The Bjerrum fields were essentially normal with the exception of bilateral central scotomas. Funduscopic examination revealed normal optic discs and normal vasculature. The macular areas showed fine granular pigmentation and loss of the foveolar reflex. They had a punched-out appearance. A few small glistening hyaline particles were seen. Peripherally, a few small pigment clumps were noted. Hearing tests, medical and neurologic examinations were negative. Serology reports were consistently negative.

Scientific program

Keratoplasty (movie demonstration)—Dr. R. T. Paton (by invitation) New York, New York.

A New Classification of Strabismus—Dr. S. V. Abraham (by invitation) Los Angeles, California.

Richard C. Gamble,
Secretary.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

Address original papers, other scientific communications including correspondence, also books for review to *Dr. Derrick Vail, 700 North Michigan Avenue, Chicago 11, Illinois;* Society Proceedings to *Mrs. Katherine F. Chalkley, Lake Geneva, Wisconsin.* Manuscripts should be *original copies,* typed in *double space,* with wide margins.

Exchange copies of medical journals should be sent to *Dr. F. Herbert Haessler, 324 East Wisconsin Avenue, Milwaukee 2, Wisconsin.*

Subscriptions, application for single copies, notices of changes of address, and communications with reference to advertising should be addressed to the *Manager of Subscriptions and Advertising, 700 North Michigan Avenue, Chicago 11, Illinois.* Copy of advertisements must be sent to the manager by the fifteenth of the month preceding its appearance.

Author's proofs should be corrected and returned within forty-eight hours to the *Manuscript Editor, Mrs. Katherine F. Chalkley, Lake Geneva, Wisconsin.* Twenty-five reprints of each article will be supplied to the author without charge. Additional reprints may be obtained from the printer, the George Banta Publishing Company, 450-458 Ahnaip Street, Menasha, Wisconsin, if ordered at the time proofs are returned. But reprints to contain colored plates must be ordered when the article is accepted.

OPTICAL REBATES

At the June meeting of the American Medical Association, ophthalmologists and the Section on Ophthalmology came in for severe criticism and condemnation from the House of Delegates for accepting and permitting acceptance of optical rebates. This unethical practice has officially been censured by means of a resolution of many years' standing in the Section. There is no question that a very large number of members of the Section have given this resolution lip service only. The subject has been discussed formally at many meetings of the Section.

Members will recall the effort some years ago to make the practice more acceptable by notices displayed in some physicians' and in certain opticians' offices to the effect that the optician was acting as the physician's agent only. By this subterfuge, which one can be sure was not thoroughly understood by the patient, the optician dispenses the glasses and turns back to the physician a certain percentage of the profit.

That the government does not consider this to be a sound and honest business practice is shown by the civil suits initiated a short time ago in various parts of the country, on the part of the Attorney General against certain optical houses and certain physicians. These cases have not as yet been tried and, therefore, no comment at this time is warranted, except to say that the choice of the ophthalmologists who must defend themselves appears to be pretty haphazard and unfair, like picking names out of a hat. The government's answer to this complaint appears to be that there are so many ophthalmologists involved it would be impracticable to bring them all into court.

The acceptance of optical rebates is a vestigial practice left over from the days when physicians accepted kickbacks from druggists and undertakers and split fees with other physicians and professional men. Medicine has pretty well cleaned its house of the latter practices, although fee splitting and other kickbacks undoubtedly take place here and now. The splitting of fees among physicians is certainly an infrequent event now days. On the other hand, the acceptance of rebates by ophthalmologists is unfortunately nearly universal, judging from reports from various sources.

Why should this be? The argument most frequently heard is that the patient is unwilling to pay the full fee to which the ophthalmologist is entitled because of his long years of training in a special, skilled field of medicine. Therefore, part of this fee must come from the sale of glasses. Most ophthalmologists are unwilling to place optical shops in their offices, or to do the fitting themselves, or to hire an optician to do it for them. Many, however, particularly those in the smaller communities, do just this. There is nothing unethical about it, although it is a little repugnant to a professional man to conduct an optical business on the side. But the conscientious ophthalmologist, placed in this position, will do the optical work or see that it is done under his direct supervision and business responsibility, in order to render the best service possible to his patients.

What wrong then is done if an optical house acts for the ophthalmologist as his agent? Simply this. The ophthalmologist has no responsibility, financial or otherwise, in the running of the optical house. Theoretically, he can determine the price of the finished product under this arrangement. Practically, however, the cost of the frames and lenses is pretty well established for him, and it is at this point that the government becomes interested. The ophthalmologist, therefore, is given the difference between the wholesale cost of the glasses plus a profit to the optician and what the patient pays. The physician neither sells goods nor renders fitting service. The patient rarely understands the mechanism and the cost of the spectacles is maintained at a high level.

Many optical houses don't even bother to display a sign mentioning the agent status. Cynically, these places will notify the ophthalmologist from time to time that a certain sum is credited to him, and at the end of the month a check is sent him, with or without an invoice. One can be very sure that the patient knows nothing whatever about this deal.

Rebates form a substantial part of the ophthalmologist's income and once he becomes seduced by this pernicious and unethical practice, he is pretty well lost. If his conscience pricks him, he stills it by saying that the rebate is part of his fee. The young man, just starting into practice in a community, soon finds himself, frequently against his will, compelled to accept rebates. Pressure is placed on him by other ophthalmologists and by the opti-

cal houses themselves. If he remains firm in his conviction, he is forced into dispensing his own glasses received from a reluctant wholesaler.

In a number of instances, the ophthalmologist will accept the rebates and turn them over to a clinic or hospital or, perhaps, to some charity, thus salving his conscience, but also, at the same time, keeping alive this vicious and seductive practice.

The optical houses are eager to keep this system alive because, although it is a bookkeeping nuisance to them, the optometrist and the department store dispensers of lenses, which far outnumber the ophthalmologist, can charge the full rate for the glasses and pocket the difference between cost and selling price as their profit on the examination and dispensing. It will be illuminating and instructive to follow the government suits to see how this matter of price fixing is developed. It is obvious that the patient of the ophthalmologist who does not accept rebates, and there are a number of them, and the patient of the one who does pay the same price. The former is thus penalized financially, and it may well be that the reputable ophthalmologist is shunned because his fee is too high.

What can be done about it? The optical houses can be forced by the government to turn back the rebate to the patient himself. This is possible, but not likely at the moment, for the opposition by the optometrists and department stores is a powerful one. The only other escape is for each ophthalmologist to refuse to take rebates in any form whatever, charge and collect his own fee based on the value of his services to the patient, and to inform the latter so that he thoroughly understands that the price he pays for glasses is that set by the opticians and the optical houses. The patient must be made to understand that in so paying this high charge for his spectacles he is subsidizing the optometrist and department-store dispenser, and that the ophthalmologist receives no part of the transaction.

This is an exceedingly difficult thing to do, especially in the smaller communities and by the young ophthalmologist. Many patients will turn to the optometrists, and the physician's income will be greatly cut. However, the ophthalmologist will sleep better at night and enjoy his own company and that of his colleagues more. In time, which will be the shorter the sooner all ophthalmologists get together, the public will know what is going on and the prestige of ophthalmology, grievously hurt by this practice, will rebound to its proper stature.

Why should the ophthalmologist cheapen himself and his great service for the benefit of the optometrist?

DERRICK VAIL.

WILMER RESIDENTS ASSOCIATION

The sixth clinical meeting of the Wilmer Residents Association was held at the Wilmer Ophthalmological Institute, on April 17, 18, and 19, 1947. The individual presentations will, in time, be published and become available to all, but viewing the program as a whole gives an insight into the scope and caliber of the work being done at Wilmer Institute—a view that is not obtained by reading separate papers. Then, too, as publication is often delayed, the program should interest a reader of the JOURNAL, since it indicates where and by whom authoritative investigation is being carried on in relation to particular subjects in which the reader may have special interest.

On the first morning staff rounds were held in conjunction with the medical department, the subjects of "Sarcoidosis" and "Progress of Arteriolar Disease" be-

ing reviewed. Dr. Alan Woods and Dr. Jonas Friedenwald discussed the eye aspects of the cases. Dr. McGee Harvey, Dr. Murray Fisher, and Dr. James Bordley presented the medical aspects. It was indeed enlightening to hear such authorities discourse about these subjects.

The formal eye program followed. A paper on "Ocular Effects of Tridione," a new anticonvulsant, was presented by Dr. Louise Sloan. Approximately 30 percent of patients being treated with tridione (3,5,5-trimethyloxazolidine- 2,4-dione) report some degree of glare when going from indoors to brightly lighted outdoors. Because of the glare effect, objects at a distance appear indistinct and colors seem faded. The intensity of symptoms is related to the dosage of the drug. Photophobia begins within 10 days after medication is started, and disappears within a week or two after its discontinuance. The eyes appear normal to examination. In order to understand the photophobia, visual acuity, light discriminatory sense, and flicker phenomena were studied under a variety of illuminations, and it was found that visual acuity and light discriminatory sense were definitely diminished, particularly under conditions of bright illumination; whereas, they were relatively normal with low illumination.

Dr. William Owens, the senior resident, presented cases of "Retrolental Fibroplasia" that had been under observation since birth, and in which the gray opacity behind the lens had been observed in the process of development. He felt that 15 percent of very premature babies, and about 3½ percent of all premature babies would show retrolental fibroplasia. It will be remembered that Dr. Terry found about 12 percent in his series of premature infants. The process is not considered to be related to remnants of the hyaloid system.

"Roentgen Irradiation in the Treatment of Ocular Diseases Characterized by New-Formed Blood Vessels" was the subject of a presentation by Dr. Jack S. Guyton and Dr. Algernon B. Reese. Cases of Eale's disease and diabetic retinitis proliferans were cited, and favorable results were obtained. The X-ray technique was similar to that used in the treatment of retinoblastoma. Special X-ray portals, developed at the Cancer Memorial Hospital in New York, are needed.

Dr. Maumenee presented a paper entitled "Experimental Study of Corneal Transplants," which will be published in the near future.

Dr. John M. McLean showed the technique and examples of "Surgery of the Paretic Inferior Oblique." The muscle is advanced onto the sclera beyond the insertion, in line with the insertion. The results were very satisfactory. Overcorrections can be obtained.

A clinical pathologic conference was conducted by Dr. Snip and Dr. Friedenwald, demonstrating interesting cases that had been seen at the Institute, with pathologic sections.

On the second morning the program began with a paper by Dr. Robert E. Kennedy on "Cystic Malignant Melanoma of the Uvea." "The Role of Rutin and Anticoagulants (Dicumarol) in Retinal Vascular Disease" was the subject of Dr. Angus L. MacLean's paper. "Tantalum Implant for Glaucoma" was discussed and demonstrated by Dr. Malcolm W. Bick.

"A Fixation Light for Testing the Six Cardinal Positions of the Eye" (see the JOURNAL, volume 30, page 611) was demonstrated by Dr. William C. Owens. The apparatus is set up so as to keep the light fixated at the same distance from the eye in all cardinal positions, and allow the examiner's hands to be free for using prisms or for the cover test.

Dr. Jonas Friedenwald presented an

impressive summary of his "Studies of the Physiology, Biochemistry, and Cytopathology of the Cornea in Relation to Injury by Mustard Gas and Allied Agents." Dr. Albert Snell and Dr. John Schilling gave an interesting paper on the "Use of the Anterior Chamber of the Eye in Cancer Research," demonstrating the conditions which are favorable and unfavorable for growth of tissue in the anterior chamber.

Dr. Alan C. Woods spoke on "Chemotherapy in Ocular Tuberculosis." Diasone appeared to have a beneficial effect with immune allergic rabbits, although its clinical trial in the treatment of tuberculosis has yielded disappointing results.

"Injection of Saline into the Eye in Retinal Detachment" was discussed by Dr. Guyton. Drainage holes were made in the sclera over the detachment, and as much as 10 to 20 cc. of saline were injected into the vitreous cavity. This ran out of the drainage holes, and the flow of current tended to force the retina back against the sclera. Coincidentally, a fluid vitreous was created which may, in some cases, allow the retina to settle down. This method of treatment was used only in special cases—when previous operations were unsuccessful, in some aphakic eyes, and when the retina remained elevated after other drainage procedures had been tried.

Dr. Samuel D. McPherson, in his paper on "Sympathetic Ophthalmia," stated that a high percentage of cases of sympathetic ophthalmia show a positive skin test for sensitivity to uveal pigment, as judged by biopsy of the skin at the site of the injection of pigment. Dr. McPherson assumes that the sensitivity reaction allows the etiologic agent to become effective. Sensitivity is also present in cases of trauma and Vogt-Koyanagi syndrome, but in a much lower percentage of cases than in sympathetic ophthalmia. The sensitivity is not due to the melanin, but to the cellular substance in which the melanin granules appear.

Dr. Charles E. Illiff demonstrated a "New Type of Beta-Ray Applicator." The Burnam-type applicator, previously described by him, utilizes the radon bulb. This bulb is a container filled with the gas, radon, which is a breakdown product of radium. A small window in the covering of the bulb allows a point source of radiation of high intensity which is ideal for occluding blood vessels. Because radon is so difficult to obtain, a new applicator was devised which uses the radium salt spread over the plaquelike end of the applicator. The radon is held in the interstices of the radium salt, and Beta rays are given off as surface fire rather than a point source, as in the Burnam applicator. However, only 50 mg. of radium can be spread on the applicator surface, or the radium itself will act as a filter to lessen the relative ratio of Beta to Gamma rays. The new applicator delivers per unit area only one fourth to one fifth the amount of Beta radiation delivered by the radon bulb of equivalent strength. This limits the use of the new applicator to conditions that can be treated by surface fire. These conditions are vernal conjunctivitis, tuberculous scleritis, and small tumors of the anterior segment. It is not practical to attempt to occlude blood vessels with surface-fire therapy. A special holder is made for the applicator.

On the third morning, the first speaker was Dr. Wilhelm F. Buschke, and his subject was "Experimental Production of Dinitrophenol Cataract in Chickens."

"New Types of Plastic Implants after Enucleation" were demonstrated by Dr. Russell T. Snip. The Guyton implant proved most satisfactory in his hands.

"The Oculocardiac Syndrome: Differential Diagnosis" was the subject of Dr. Frank B. Walsh's presentation. He

stressed the importance of recognition of this syndrome in cases of facial injuries, for, if it were not diagnosed, intracranial lesion might be suspected to be the cause of vagal stimulation, when actually it would be due to injury to the eye.

"The Use of Di-isopropyl Fluorophosphate (D.F.P.) for Glaucoma" was reviewed by Dr. William G. Marr. He stated that when pilocarpine, furmethide, or eserine fail to hold the tension, D.F.P. will not hold it either. Administration of D.F.P. to many patients causes discomfort because of the extreme miosis and ciliary spasm. Some patients have shown sensitivity to peanut oil, the vehicle for D.F.P.

"Use of Furmethide for Glaucoma" (see this JOURNAL, page 999) was discussed by Dr. Ella Uhler Owens. In early cases mecholyl and prostigmine were found to be more satisfactory, and furmethide more effective in late cases. Furmethide is often effective where pilocarpine and eserine have failed, especially in cases with high tension and complications, as after venous closure. Furmethide is now available through Smith, Kline, and French Laboratories, Philadelphia.

The final paper by Dr. Samuel Talbot and Dr. Stephen Kuffler was entitled "Apparatus for Chromatic Stimulation of Single Nerve Fibers of Mammalian Retina. Demonstration of Corneal Potential."

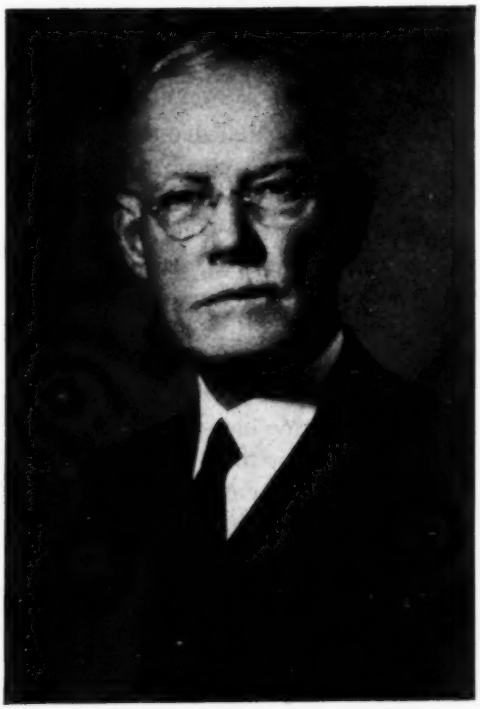
The organization of the program, to interest both the research worker and the practical clinician, and the manner of delivery of every speaker as well as the wealth of information presented were an inspiration to those attending the meeting, and a tribute to the Professor of Ophthalmology of Johns Hopkins University, Dr. Alan C. Woods.

S. RODMAN IRVINE.

OBITUARY

EDWARD COLEMAN ELLETT
(1869-1947)

Edward Coleman Ellett, known affectionately as "The Colonel" to all who attended the meetings of the Ophthalmic societies, died of coronary occlusion in the Atlantic City Hospital on June 7th. After attending the session of the American Ophthalmological Society at Hot Springs, Virginia, with Mrs. Ellett, he was stricken on the train en route to the Centennial Celebration of the American Medical Association. Aware for the previous 18 months of the possibility of such an end, his interest in medicine and his specialty drove him to attendance at all meetings, local and national, and to active participation in the discussions. He never failed to contribute some worthwhile suggestion in the field of ophthalmology.



Blackstone Studios, New York

EDWARD COLEMAN ELLETT

He was born in Memphis, Tennessee, December 18, 1869, the son of Judge Henry T. and Katherine Coleman Ellett. His formal education was received in Memphis private schools, Southwestern Presbyterian University at Clarksville, Tennessee (now Southwestern College at Memphis), and the University of the South at Sewanee, Tennessee. Both schools at later dates conferred upon him honorary degrees, Southwestern College the degree of doctor of law, in June, 1942, and the University of the South, the degree of doctor of science, in June, 1943. Dr. Ellett studied medicine at the University of Pennsylvania from which he received his doctor-of-medicine degree in 1891 and from which he was graduated as top man in the class. An internship at St. Agnes Hospital and a residency at Wills Eye Hospital, Philadelphia, prepared him for a long life of service in his home community. This service was acknowledged by his colleagues with a testimonial dinner in May, 1943, to celebrate his 50th year of active practice of medicine in Memphis.

In 1896, he was married to Nina Polk Martin and with her, last year, celebrated the 50th anniversary of a marriage which has been a symbol of love and devotion. Their mutual interest allowed them to enjoy many things in common, especially travel. Almost every summer they went to Europe, usually stopping in southern France, which both of them loved so well. They travelled in South America several times and made numerous trips to Havana. Wherever they might be, Dr. Ellett sought out the ophthalmologists, making firm friendships, which have endured, and picking up any new procedures and techniques which he could fit into his own surgical program.

"The Colonel" was a great teacher. For 16 years he was Professor of Ophthalmology at the University of Tennessee Medical School, but his main interest was in graduate teaching in ophthalmology. In this field he had many associates in his private office, who later branched off into their own practices in Memphis and other cities, continuing successfully the precepts he taught so well. At his own expressed wish 11 of them were honored by being asked to carry him to his last resting place. His interest and regard for them were maintained until the very end.

Dr. Ellett's interests were mainly in clinical ophthalmology and his papers were based, as a rule, on the experiences of actual practice. Too numerous to record, there is scarcely a one which cannot yet be read with profit. He attended medical meetings religiously and was an active participant in discussions, disclosing a tolerant attitude toward the opinions of others but being firm in his own convictions. His tall, spare, and erect figure, was a familiar sight whenever the Academy, the A.O.S., or the Section on Ophthalmology was in session. During intermissions he was usually engaged in conversation with someone who had a problem to solve. Or, he was passing on the most recent anecdote which had come to his attention, for he loved a good story and told it well.

He delighted in the success of those men on whom he had exercised some influence through hospital connections, military life, or acquaintance at ophthalmic meetings. No request for advice was ever refused and, because of his long years of experience and scientific training, he usually had some worthwhile suggestion to offer. As a consultant, he was understanding and kindly and had the ability to alter a course of therapy without destroying the patient's confidence in his physician. His mind was always active and alert. If a certain form of treatment proved unavailing, he never hesitated to change to another even though the sug-

gestion might come from the most recent of his associates. He respected the dignity of man and was always willing to concede the merit of an idea and place proper credit where it was due.

I well remember the incidents of our first meeting, 21 years ago, and the conversations relative to the long and pleasant association which we enjoyed through all those years. After satisfying ourselves that such an association might be mutually agreeable, the question arose as to the need of a written contract. "The Colonel's" remarks were, "Doctor, I don't think we need one. An association in the practice of medicine is like a marriage. It will either work or it won't and if it won't work, a written contract isn't going to make it do so." It was on such terms that our association persisted and our relations were more like those of father to son than as senior to junior partner.

One idolizes and idealizes someone he loves, and the tendency is to allow sentiment to gloss over such defects as become apparent when the initial enthusiasm of a new association tends to wane. I never had cause to regret the good fortune which brought me to an association with Dr. Ellett. During all those years, there was never a serious difference of opinion, although one's opinion was frequently required; and at the close of 21 years of daily contact my love and respect for Dr. Ellett were exactly the same as when formed at the initial meeting. Dr. Ellett's professional ability and integrity, his innate courtesy, his genuine kindliness and interest in the troubles of others always made him a tower of strength to his family and his friends in moments of personal distress.

His professional attainments and honors were most numerous. He belonged to every local, state, and national medical organization both in general medicine and his specialty. He had served as president of the Memphis and Shelby County Medical Society, the Memphis Society of Ophthalmology and Otolaryngology, the Tennessee Academy of Ophthalmology and Otolaryngology, the American Academy of Ophthalmology and Otolaryngology, the American Board of Ophthalmology, and the American Ophthalmological Society, and was chairman of the Section on Ophthalmology of the American Medical Association and vice-president of the Southern Medical Association and the National Society for the Prevention of Blindness. He had served as an associate editor of the AMERICAN JOURNAL OF OPHTHALMOLOGY.

The Academy honored him with the Award of Merit; the Board, with a testimonial silver tray; and the National Society for the Prevention of Blindness, in conjunction with the St. Louis Society for the Blind, awarded him the Leslie Dana Medal. The Memphis and Shelby County Medical Society and the Memphis Society of Ophthalmology and Otolaryngology honored him on separate occasions with testimonial dinners.

During World War I, Dr. Ellett commanded Base Hospital 115 at Vichy, France, for which he received a citation for meritorious service. While in the Medical Corps, he was made a full Colonel, a title by which he was known the rest of his life.

Dr. Ellett was a member of Calvary Episcopal Church.

His fraternal orders were Kappa Sigma and Phi Alpha Sigma, and he belonged to the Memphis Country Club and the University Club of Memphis. As a member of the Waponoca Club, he was able to satisfy his enthusiasm for golf, tennis, and hunting—sports which he thoroughly enjoyed to the very last. "The Colonel" had an inner drive toward perfection which motivated his every action. He was constantly learning. At 60 years of age, he

took lessons to improve his Spanish and his backhand in tennis, with considerable success in both efforts. He was always willing to impart any such knowledge to those who desired it. Never will I forget the occasion, when my golf ball was lying against a fairway bunker and I insisted, with the usual result, on using the wrong club to gain distance. On my desk the following morning was an illustrated book on golf, opened to the page showing the exact situation of the previous day and demonstrating that a nine iron was the only club of choice. A good shot, Dr. Ellett enjoyed gunning afield for quail and pheasant and over the water for ducks and geese, and some of his most pleasant reminiscences were of days in the open.

Despite his love of sports and interest in medical affairs, Dr. Ellett's devotion to his patients and their devotion to him was inspiring. No complaint was too trivial to be heard to the end and no one suffered more than he did if a case of failing vision could not be halted or if sight could not be restored. His interest in the welfare of his patients was sincere and sustained, and regardless of the condition of his own health, he somehow always had time for those requiring his services. He was never too busy to stop to listen to a disconcerting problem or to have a look at the patient who was not doing well. Always there was some beneficial suggestion or the kindly assurance that all that was possible was being done.

A deft surgeon, Dr. Ellett pioneered in this country many of the surgical techniques that are now standard procedures, such as intracapsular cataract extraction with the corneoscleral suture, the Elliott corneoscleral trephining, the diathermy treatment of retinal separation, and plastic dacryocystorhinostomy. He was the center of a large audience in the operating theatre and never failed to give his most masterly performance in the presence of on-lookers. He maintained his steady and accurate hand to the very last and, although restricting his office practice to consultation only, continued his intraocular surgery daily until the end. It was always an inspiration to watch him at work for there was a minimum of action, everything being done in the simplest and most direct way to achieve the desired result. His techniques and teachings were indelibly impressed on a large number of associates and residents, and he will live on in the works of those who were his students.

Wise counsellor and staunch friend, it seems strange not to hear his light footfall and feel his firm hand on one's shoulder as he comes to the examining room to impart a bit of advice or some news of mutual interest. But his influence will endure and mold the lives of all who knew him.

RALPH O. RYCHENER.

BOOK REVIEWS

A TREATISE ON GONIOSCOPY. By Manuel Uribe Troncoso, M.D. Philadelphia 3, Pennsylvania, F. A. Davis Company, 1947. 318 pages, 117 illustrations (35 in color), index, and bibliography. Price $10.00.

The important pioneer work on this subject and the instrumentation devised by the author are too well known to need comment. This book represents the crowning achievement of a lifetime devoted to the study of the angle of the anterior chamber by Dr. Troncoso. It is clearly written and illustrated and is a work of great significance in ophthalmology.

Gonioscopy, or the art of examining and interpreting the conditions seen in the anterior chamber of the living subject, has had a difficult evolution. It has

taken many years to attract the attention that it deserves, and it is only in recent time that the procedure is becoming more popular. Part of this delay has been the somewhat time consuming and difficult technique hitherto necessary. In these days of overburdened practices, the ophthalmologist hesitates to devote any time to a study that seemed to offer so little reward to the patient or to himself in adding to the judgment of the case. More and more information appearing in our literature is coming from authorities whom we have learned to respect and trust, and more and more converts are being made. Improvements in the instrumentation and in the technique, owing in very large measure to Dr. Troncoso's scientific outlook and acumen, have made the procedure much less formidable and time consuming. Gonioscopy is not yet as easily done as are slitlamp microscopy or ophthalmoscopy, but it is rapidly approaching these maneuvers in ease of accomplishment and clinical importance.

The author's timely book sets forth in clear terms the interpretation of the various findings in the anterior chamber in health and disease. Attention is directed to the importance of a visual study of the angle in various kinds of glaucoma, as an aid particularly in the choice of an operation or in the analysis of its failure. Inflammatory conditions, tumors, foreign bodies, congenital anomalies, and changes in age affecting this area are a part of gonioscopy, as developed by the author. Prof. Ida Mann has written, especially for this book, a chapter on "Development of the Angle of the Anterior Chamber in the Human Eye," which is a classic.

The publishers have done a splendid job. The book is beautifully printed, and the illustrations, particularly the colored ones, are to be commended. It is a pleasure to possess this book and to use it, and it is inconceivable that any ophthalmologist would deny himself this pleasure, especially in a world so full of woe.

DERRICK VAIL.

UEBER NICHT HYPOPHYSÄRE CHIASMASYNDROME. By M. Gil. Espinosa (Madrid). Supplement of Ophthalmologica. Basel, Switzerland, S. Karger, 1946. 60 pages, 15 illustrations, paperbound. Price 7.50 Swiss francs.

This well-written monograph adequately discusses what is known as the Chiasmal Syndrome, a term coined by Cushing, who presented a paper with this title before the International Congress of Ophthalmology in Amsterdam, in 1929. (*Archives of Ophthalmology*, 1930, volume 3, pages 505 and 704.)

After a description of the signs and symptoms of a lesion in the chiasmal area, the author discusses the nature of the lesions and the differential diagnostic points of significance. There is thus presented a short analysis of hypophyseal adenoma, craniopharyngioma, tumors of the IIIrd ventricle and of the infundibulum, arachnoiditis opticochiasmatica, glioma of the chiasm, aneurysm, granuloma, suprasellar cholesteatoma, meningioma of the base of the skull, and indirect compression of the chiasm. However, not much has been added to the subject so ably expressed by Dr. Cushing and other American authors.

DERRICK VAIL.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

6

CORNEA AND SCLERA

Fuchs, Adalbert. **The influence of general metabolic and nutritional disturbances upon the resistance of the cornea.** Amer. Jour. Ophth., 1947, v. 30, June, pp. 721-727. (5 references.)

Harbert, F., and McPherson, S. D. **Scleral necrosis in periarteritis nodosa.** Amer. Jour. Ophth., 1947, v. 30, June, pp. 727-732. (6 figures, 11 references.)

Morone, G. **Researches on the sensibility of the transplanted corneal discs in keratoplasty.** Ann. di Ottal. e Clin. Ocul., 1946, v. 72, May, pp. 279-297.

The author presents 11 cases of keratoplasty in which the sensibility of the cornea with respect to touch, temperature, and pain was tested with the esthesiometer and technique of Puglisi-Duranti. The transplanted disc, whether it becomes opaque or remains transparent and unvascularized, may acquire a sensibility of its own after the lapse of a year. Such sensibility is always inferior to that of normal cornea, and the cornea of the host is often hypesthesic as well. A warm stimulus is usually well perceived as such. The sensibility of the transplants seems to depend but little on the nature of the postoperative course, on the age and sex of patient and donor, and on the width of the cicatricial band around the transplant.

The anatomy of the innervation of the cornea and the physiology of its sensibility are reviewed.

Harry K. Messenger.

Seidenari, R. **Histologic aspects of refrigerated corneal epithelium.** Ann. di Ottal. e Clin. Ocul., 1946, v. 72, May, 298-316.

A detailed study is presented of the histologic changes that occur in the epithelium and in Bowman's membrane of refrigerated and nonrefrigerated human corneal tissue, specimens of which were examined at ½, 2, 5, 10, 24, 36, and 48 hours after death. (The article is accompanied by a complete series of comparative photomicrographs.) The refrigerated corneal tissue was kept in small glass vessels surrounded by finely

chopped ice; the controls were kept at room temperature.

Exfoliation occurred in both instances, but sooner and more rapidly in the nonrefrigerated cornea, whereas the histochemical properties of the cytoplasm and nuclei of the cells of the basal layer remained nearly normal for 48 hours in the refrigerated tissue. Likewise the refrigerated tissue remained acidophilic much longer. There was no essential difference in the behavior of Bowman's membrane.

Harry K. Messenger.

Seidenari, R. **Histologic aspects of refrigerated corneal parenchyma and endothelium.** Ann. di Ottal. e Clin. Ocul., 1946, v. 72, June, pp. 363-375.

A comparative histologic study was made of the condition of refrigerated and nonrefrigerated corneas at intervals of one half to 48 hours after death. The nonrefrigerated corneas were kept at room temperature; the others were refrigerated in a small glass container surrounded by melting ice. It was found that in the refrigerated specimens the thickness of the cornea is less than in the nonrefrigerated, and the thickness of Descemet's membrane is practically unchanged. In the refrigerated group the normal acidophilic properties of the tissues are retained even after 48 hours, whereas they disappear by the fifth hour in preparations not exposed to the action of cold. Likewise the individuality of the lamellae is preserved even after 48 hours of refrigeration, whereas dissociation begins four hours after death in the nonrefrigerated specimens. Harry K. Messenger.

Senigaglia, A. **The syndrome of Van Der Hoeve with psychopathy.** Riv. Oto-Neuro-Oft., 1946, v. 21, May-Aug., pp. 236-244.

A woman 39 years of age with negative family history, had slight depressive psychosis, marked tendency to fractures after slight traumas, deafness which became manifested when she was 30 years of age, and blue scleras. The symptomatology and pathogenesis are discussed. (2 figures, bibliography.)

Melchiore Lombardo.

Stenstam, Toivo. **On the occurrence of keratoconjunctivitis sicca in cases of rhenmatoid arthritis.** Acta Med. Scadinav., 1947, v. 127, no. 1-2, pp. 130-148.

The material for the study was provided by 495 hospital patients with rheumatoid arthritis ranging from 12 to 55 years of age. Sixty of the 495 cases of arthritis were cases of acute rheumatic fever. Forty-seven of the patients had keratoconjunctivitis sicca. Only one of the 47 occurred in those suffering from rheumatic fever. Because of the joint symptoms these patients attended the rheumatological clinic more frequently than the eye clinic and this fact probably explains the rare occurrence of this eye disease in the out-patient visitors at the eye clinic. Sjogren found one case of keratoconjunctivitis sicca in every 2,000 patients with disease of the eye.

Neurological and clinical studies brought out nothing of importance. Males and females were practically equally affected. The Wassermann reaction was negative in all the patients with keratoconjunctivitis sicca; tuberculin tests were positive in as many cases of arthritis with this disease as without. All these facts make it unlikely that the arthritis and laboratory findings are typical of or are a part of this ocular condition.

Francis M. Crage.

Torres Estrada, Antonio. **Keratoplasty relieving blindness of 42 years duration.** Bol. del Hospital Oft. de Ntra. Sra de la Luz, 1946, Nov.-Dec., and 1947, Jan.-Feb., pp. 245-248.

The right eye, staphylomatous, had been enucleated, and the left eye had been blind for 42 years by reason of a large central leucoma, adherent in the lower part. Optical iridectomy at the 12 o'clock position had produced little improvement. Fortunately the more or less quadrate staphyloma was surrounded by a transparent zone. The keratoplasty was performed on May 20, 1946, using Castroviejo's technique. The continuous suture was removed after 12 days, and the eye was left uncovered after 16 days. The patient was discharged from the hospital after six weeks, with corrected vision of 0.6, and two months later the glasses were changed with further improvement of vision to 0.8. A still further slight change on January 18, 1947, gave vision of 0.9. W. H. Crisp.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Campos, Raffael. **Clinical investigation of colloidometry of the aqueous humor.** Arch. di Ottal., 1946, v. 50, Nov.-Dec., pp. 237-255.

The colloidometer of Roenne and the method of using it are described. The clinical histories of seven cases of anterior uveitis are reviewed. Repeated colloidometry reaffirmed the clinical value of these measurements.

Francis P. Guida.

Haefeli, W. **The permeability of the blood-aqueous barrier for fluorescein.** Ophthalmologica, 1946, v. 112, Oct.-Nov., pp. 226-254.

Amsler and Huber (Ophthalmologica, 1946, v. 111, p. 156) have devised a simple optical method for the quantitative determination of fluorescein in the aqueous in situ. After the intravenous injection of 2 c.c. of a 10-percent solution of fluorescein sodium, the eye is observed with slitlamp and corneal microscope for the appearance of a green tinge of the aqueous, the intensity of which is measured by dimming, by means of a rheostat, the slitlamp light to the point of disappearance of the green fluorescence. At this extinction point, the intensity of the electric circuit feeding the lamp is inversely proportional to the concentration of fluorescein in the aqueous. With this method the passage of fluorescein into and out of the aqueous has been studied quantitatively on a large number of individuals with normal eyes. The results are presented statistically.

Under the conditions described in the foregoing, fluorescein becomes visible in the aqueous two to four minutes after the injection. The highest fluorescein concentration is reached 25 to 30 minutes after the injection. Children under 15 years of age show increased permeability to fluorescein. Two eyes of the same individual usually behave similarly as far as the passage of fluorescein into and out of the eyes is concerned. After reaching the peak, the fluorescein concentration in the aqueous diminishes very gradually, much more slowly than in the blood. Repeated fluorescein tests on the same individual show very slight variations. In none of the tests on normal eyes was there any optically demonstrable increase in the protein content of the aqueous during the fluorescein experiment. P. C. Kronfeld.

Mathis, G. **Three cases of congenital,**

bilateral aniridia. Rassegna Ital. d'Ottal., 1943, v. 12, March-April, p. 133.

The writer reports three cases of aniridia and discusses the principal theories of its etiology and pathogenesis. The patients had defects of the nervous and mental faculties, cranial malformation, ptosis, nystagmus, opacities of the cornea and lenses, and aplasia of the fovea. These findings are held to be evidences of an ectodermal, hereditary dystrophy. Eugene M. Blake.

Newell, Frank W. **Extensive traumatic iridodialysis with repair.** Amer. Jour. Ophth., 1947, v. 30, June, pp. 695-697. (1 colored plate, 15 references.)

Pignalosa. G. **The accommodative power in subjects that have had iridocyclitis.** Ann. di Ottal. e Clin. Ocul., 1946, v. 72, June, pp. 321-335. (See Section 3, Physiologic optics, refraction, and color vision.)

8

GLAUCOMA AND OCULAR TENSION

Agundis, Teodulo, Jr. **Medical treatment of glaucoma.** Bol. del Hosp. Oft. de Ntra. Sra. de la Luz, 1946, July-Oct., pp. 200-206.

The subject is dealt with under symptomatology, miotics, derivatives of choline, and osmotic treatment.

W. H. Crisp.

Benner, R. **Diathermy puncture of the ciliary body.** Ann. d'Ocul., 1947, v. 180, Feb., pp. 89-102.

Based on 44 operations performed on 28 eyes, the detailed results of the diathermic operation of Vogt are tabulated. Approximately 75 percent of these operations followed other surgical procedures. After conjunctival and retrobulbar anesthesia, and dissection of the conjunctiva and subconjunctiva, 100 to 300 perforating and non-perforating punctures are made in the sclera, 3 to 4 mm. behind the limbus and encircling the globe. These are best accomplished with a shouldered needle 0.5 mm. long, about 0.1 mm. in diameter and with a current of 60 to 80 milliamperes.

The author confirms the experiences of Vogt, Thiel and others that this procedure is best adapted to eyes in which the risks of other surgery are high. It is less applicable to acute and primary glaucomas than to congenital, and glaucomas secondary to iritis, aphakia, and trauma. Sympathetic ophthalmia is a possible complication which the author did not encounter. (7 references.)

Chas. A. Bahn.

Gallois, J. **Chronic glaucoma with minimal elective vasodilation.** Ann. d'Ocul., 1947, v. 180, Jan., pp. 20-28.

In advanced primary glaucoma capillary degeneration is frequent, both in the eye and other tissues such as the nail bed, and is often accompanied by angiospasm and other disorders of capillary permeability. Ocular hypertension may be the result of vascular noninflammatory malformations such as nevi and arterio-venous aneurysms and of low grade inflammatory and degenerative reactions especially those involving the choroidal veins. Retinal endo- and periphlebitis are not infrequently observed in sections of eyes with primary glaucoma. Stasis, especially in the choroidal veins, frequently complicates bodily atherosclerosis. Stasis in the retinal veins is more passive, but both are aggravated by ar-

terial or capillary compression. Vasodilating substances in very small doses tend to reduce venous stasis and thereby potentially reduce intraocular tension. In larger doses they tend to increase intraocular tension. Among the vasodilating drugs thus experimentally used in glaucoma are calcium chloride, magnesium sulphite, nicotinic acid and benzylimidazoline. Based upon an apparently large number of cases and years of study the following test is proposed to determine the advisability of surgical intervention in individual patients with primary glaucoma: 30 mg. of nicotinic acid or 25 mg. of benzyl-imidazoline is slowly injected intravenously, and the tonometric tension is measured every 15 minutes during one hour. No miotic is used before or after the injection. In unfavorable cases which usually include the acute primary and secondary hemorrhagic and long standing degenerating glaucomas, the tension is stationary or somewhat increased, which means that miotic treatment alone will probably not control the ocular hypertension. If the intraocular tension is lowered as it was in 14 of 18 cases observed, the continuance of proper nonsurgical treatment should be considered.

Chas. A. Bahn.

O'Brien, C. S. **Surgical treatment of primary glaucoma.** Arch. of Ophth., 1947, v. 37, Feb., pp. 134-138.

Iridectomy is preferred for the relief of acute block of the anterior chamber in cases of narrow-angle glaucoma. The operation is usually successful if the tension can be reduced to normal with miotics or if the acute attack is not of more than three days duration. An ab externo incision is preferable. Cyclodialysis is most successful in cases of early chronic wide-angle glaucoma and the secondary glaucoma which follows cataract extraction. If almost half the circumference is dialyzed the results are much better. Of the operations which open an extraocular drainage channel, the author prefers the sclerecto-iridectomy of Lagrange. The technique for these operations is described.

John C. Long.

Tiscornia, B. J. **Functional exploration of the arterioles, capillaries, and veins of the anterior segment of the eye.** Arch. Chilenos de Oft., 1946, v. 2, May-June, pp. 149-156.

The author devotes special attention to the neuroarteriolar test of Vidal and Damel (reduction of ocular tonus after instillation of ephedrine sulphate, 5-percent solution, twenty to sixty minutes); the neurocapillary test of Vidal and Malbran (instillation of a watery solution of chloride of carbaminoylcholine, producing in the normal eye a primary rise of ocular tension, followed by secondary return to normal which is absent in the eye with disturbance of the venous circulation); and the further test of Vidal and Malbran in which instillation of acetylcholine is followed by slight increase of ocular tension. W. H. Crisp.

Torres Estrada, Antonio. **Indications for iridectomy in hemicycodialysis.** Bol. del Hosp. Oft. de Ntra. Sra. de la Luz, 1946, Nov.-Dec., 1947, Jan.-Feb., pp. 237-244.

Iridectomy may be performed prior to the hemicyclodialysis, combined with it, or after its execution. The author favors previous iridectomy in all the

congestive forms of the disease, the hemicyclodialysis being performed a few weeks later, when the eye has become quiet. When the two operations are done at the same sitting, iridectomy is done after introducing the spatula, and disinsertion of the ciliary body is the final step. W. H. Crisp.

Weekers, L., and Weekers, R. **Technique of nonperforating cyclodiathermy.** Ann. d'Ocul., 1947, v. 180, Feb., pp. 76-88.

Diathermy produces uveal vasodilatation, autonomic nervous changes, and specific biochemical actions and thereby potentially reduces ocular hypertension. If properly used, the nonperforating technique is as efficient and far less dangerous than the perforating. The authors prefer a curved electrode with a round tip and an insulated shoulder to facilitate the proper pressure. After local anesthesia, the retrobulbar injection of 4-per cent procaine solution is followed by one c.c. of 40-per cent alcohol. Twelve to 20 applications of 15 seconds each are made directly on the conjunctiva and encircling the eyeball 7 to 8 mm. posterior to the limbus. The resistance is previously so regulated that the conjunctival temperature is approximately 30° C. at the instant of application and 90° C. in five seconds. The procedure is not painful, no bandage is used postoperatively and only normal salt solution is employed as an irrigating fluid. Hypotension usually begins after a few hours, though occasionally a transient but not important hypertensive phase occurs. The postoperative reaction is usually slight and after a month only a slight focal chorioretinal atrophy exists with pigment dispersion. In one of the cases reported, the operation was successfully repeated after eight months. This procedure is considered as efficient and less difficult and dangerous than operations whose success depends on opening the eyeball and delicate dissections, especially in the glaucomatous eye. (8 references.)

Chas. A. Bahn.

Weekers, R. **Incomplete glaucoma.** Ann. d'Ocul., 1947, v. 180, Jan., pp. 10-19.

Primary glaucoma is characterized by three cardinal symptoms: ocular hypertension, excavation of the disc, and visual defects, peripheral and central which are correlated with vascular disease in the uvea, the disc and the retina respectively. In primary glaucoma, these three locations are frequently not equally involved and therefore the cardinal symptoms may vary widely. Any one or two of the three cardinal symptoms may indicate an advanced stage when the other symptoms are practically absent. This the author terms incomplete glaucoma, which may be monosymptomatic, or bisymptomatic. One eye may be monosymptomatic and the other bisymptomatic. Monosymptomatic glaucoma may exist for years as such, but usually is an early stage of the bisymptomatic type. The monosymptomatic form includes glaucomatous types of excavation with ocular hypertension of 25 mm. Hg or less and practically no visual defects. Such is the lacunar degeneration of the disc described by Schnabel. Ultimately this type become bisymptomatic. Intraocular hypertension without disc excavation or visual defects is usually the initial stage of the bisymptomatic type. Ocular hypertension alone may exist for a number of years and

does not call for surgical intervention. Ocular hypertension is better tolerated in those with bodily arterial hypertension. Sudden lowering of the arterial hypertension is usually followed by aggravation of the glaucoma. Intraocular hypertension is better tolerated if the minimal arterial retinal tension is elevated. Glaucomas with low ocular tensions but with characteristic campimetric defects are more frequent in those with low retinal arterial tension. The appearance of spontaneous arterial pulsation suggests that the retina is suffering from ischemia. Defective vision with apparently normal ocular tension and disc excavation, but with arciform scotoma may represent the more or less prolonged monsymptomatic stage of an ultimately bisymptomatic glaucoma. In primary glaucoma defective vision is caused by retinal ischemia from arteriolar spasm or from extravascular pressure either in the retina proper or at the disc. Retinal damage caused by the ischemia primarily involves the second and third neurones, with typical defects in the visual fields. Defective vision with characteristic disc excavation may long coexist with ocular tension below 25 mm. Hg. Prolonged defective vision with intraocular hypertension but without characteristic disc excavation is rare. Disc excavation and hypertension without visual defect is relatively frequent, though with very small targets pathologic neuroscotoma may be found.

Chas. A. Bahn.

Weinstein, P. **Glaucoma treatment.** Amer. Jour. Ophth., 1947, v. 30, June, pp. 755-757. (2 references.)

9

CRYSTALLINE LENS

Gardilcic, A. **Extraction of the dislocated lens after Jess-Lacarrère.** Ophthalmologica, v. 112, Oct.-Nov., pp. 255-266.

Independently of each other, Jess and Lacarrère devised a method for the extraction of dislocated lense (lying at the bottom of the vitreous) by spearing and lifting them out of the eye with a needle-shaped electrocoagulation electrode.

Gardilcic has modified the method as follows. After dissecting a fornix-based conjunctival flap, the incision is started by making a limbic groove into which two corneoscleral sutures of the McLean type are inserted. Through a tiny separate groove at the three-o'clock position in the left eye and nine in the right the needle electrode is introduced into the eye. Guided by the ophthalmoscope, or, in the case of a cloudy vitreous, by a transilluminator applied to the inferior part of the sclera, the electrode is brought in contact with the lens, the needle inserted into it and the coagulating current turned on for two seconds. By careful manipulation of the handle of the electrode, the surgeon makes sure that the lens is following the movements of the needle. The limbic incision is completed with a Graefe knife and extended, with scissors, right up to the previously inserted needle electrode. The lens is extracted by manipulation of the needle electrode and a Weber loop, to depress the posterior wound lip. The author reports one success and one failure.

P. C. Kronfeld.

10

RETINA AND VITREOUS

Duehr, P. A. **Some primary considerations in retinal detachment.** Wisconsin M. J., 1947, v. 46, May, pp. 515-519.

Some of the cardinal principles of the

diagnosis and treatment of retinal detachment are reviewed. Conservative treatment which consists of absolute bed rest with pupil dilated for two or three weeks may be tried. If successful, the patient must wear pin hole discs for two months or more. Surgery is performed after bed rest of two to seven days to allow the retina to settle back. Surface coagulation was combined with perforating cautery. For the latter a coagulating current and the micropins of Kronfeld and Pischel were used. After the operation three weeks of absolute bed rest and pin hole glasses for two months are advised.

Observations of 104 eyes with retinal detachment are analyzed. Forty-three were treated conservatively, 41 were operated upon, 20 were aphakic, and 10 eyes were operated upon a second time. When 75 percent of the retina was detached all operations failed and when 50 percent of the retina was detached, there was 65 percent failure. When less than half of the retina was detached the operation was successful in 69 percent of eyes. Of nine aphakic eyes that were treated, four were cured, and in only one of the 10 eyes that were subjected to a second operation was the procedure successful.

Erwin E. Gaynon.

Lisman, J. V. **Dermatomyositis with retinopathy.** Arch. of Ophth., 1947, v. 37, Feb., pp. 155-159.

Dermatomyositis is a rare disease characterized clinically by degeneration of many of the muscles of the body together with a nonsuppurative inflammation and atrophy of the skin and mucous membranes. Retinal involvement is rare. The general mortality is 50 percent.

An example of this disease is described in a 53-year-old man. The patient had complained of progressive generalized weakness for six months. There was swelling of the eyelids. There had been increasing stiffness of all joints of the body with severe pain on extension. The muscles of the trunk and extremities were extremely tender. An erythematous, scaly eruption was present on the face in a butterfly pattern. The fundi showed numerous areas of retinal exudate reminiscent of cotton wool patches. Numerous hemorrhages were seen intermingled with the exudate. The patient died of erysipelas and bronchopneumonia. Examination of the sectioned eye showed occasional hyaline or lipid changes in the external plexiform layer and a few small scattered hemorrhages. John C. Long.

Mecca, M. **The retinal arterial pressure after lumbar puncture.** Ann. di Ottal. e Clin. Ocul., 1946, v. 72, June, pp. 336-362.

Observations made in 19 carefully studied cases of lumbar puncture lead to the conclusion that the retinal arterial pressure follows a more or less constant pattern. At first it rises, then slowly and gradually falls, reaching its previous level in 12 to 24 hours. The initial increase is of course related to the disequilibrium of the intracranial pressure resulting from the lumbar puncture. It is thought to be linked with the accompanying vascular phenomena, but no very plausible explanation is adduced. In the majority of cases an increase in the extent of the visual fields was noted. This is attributed to the increase in retinal blood supply which follows the rise in vascular pressure.

The literature on the relation of the intracranial and retinal arterial pressures is discussed at length.

Harry K. Messenger.

Mulock Houwer, A. W. **Potassium iodide and vitreous opacities.** Ophthalmologica, 1946, v. 112, Oct.-Nov., pp. 289-291.

On a middle-aged myopic patient, Mulock Houwer had performed an extracapsular extraction followed by a needling. A fairly large tent-shaped vitreous hernia with its apex incarcerated in the corneal scar had resulted from the needling. In this vitreous hernia, the essayist observed the development of vitreous opacities and their disappearance after potassium iodide medication. P. C. Kronfeld.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Bell, P. G., and O'Neill, J. C. **Optic atrophy in Hong Kong prisoners of war.** Canad. M. A. J., 1947, v. 56, May, pp. 475-481.

The last war has produced for the first time a considerable number of cases of optic atrophy in the white prisoners of war taken by the Japanese. The author's report includes studies on 95 cases of optic atrophy in about 20 percent of the prisoners of war, returned after 4 years of captivity in Hong Kong.

An excellent army medical report described the prisoner's diet. It was composed largely of polished rice, with the occasional addition of half rotten fish or meat, soya beans, a little flour and sugar, and a fair quantity of mixed vegetables. Water was freely available. Vile-tasting, weedy greens were eaten sparingly on the advice of medical officers. Deficiency diseases began after about six months of imprisonment. Men unable to work at their designated tasks (hard labor) had their meager rations decreased. Most of the men had beri-beri and pellagra.

The author's cases resembled the late results of the toxic amblyopia of tobacco or severe bilateral retrobulbar neuritis. There was an optic atrophy affecting mainly the papillomacular bundle with a small dense centrocecal scotoma causing loss of vision and slight if any peripheral field changes. Temporal disc pallor, a most unreliable sign except in the severe cases, was the only other objective finding.

Fifteen percent of the patients showed a difference of three or four lines between the vision of the two eyes. Twenty-three of the 95 patients had a vision of 20/200 or worse (economically blind). All the patients had fairly normal peripheral fields. Their greatest difficulty was reading and the performance of fine work.

It was felt that the etiology was a combination of an unknown B complex deficiency associated with a hypoproteinemia or lipemia and an added toxic factor from mouldy rice affecting congenitally weak optic nerves.

Most of the patients with a visual acuity of 20/100 or worse were given spherical reading glasses of +6 to +14 diopters with an occluder for either eye. This permitted reading newspaper type at three or four inches. The occluder prevented convergence asthenopia. Francis M. Crage.

Chamlin, Max. **Papilledema and papillitis.** Amer. Jour. Ophth., 1947, v. 30, June, pp. 741-747. (3 figures, 8 references.)

Ferrera, A. **Optic neuritis from high doses of atebrin.** Rassegna Ital. d'Ottal., 1943, v. 12, March-April, p. 123.

A girl, nine years of age, acquired ma-

laria and was given three tablets of atebrin a day for five days and two tablets of plasmochina the next three days. Disturbance of vision in the right eye developed shortly afterwards, and an optic neuritis, with limitation of the field and the usual fundus changes were present. Recovery occurred in 20 days after intravenous injections of calcium and high doses of vitamin B. The left eye had previously had a tuberculous uveitis. Eugene M. Blake.

de Ocampo, G., Yambao, C. V., Managas, P. J., and Sevilla, C. L. **Epidemic retrobulbar neuritis in the Philippines during the Japanese occupation.** Amer. Jour. Ophth., 1947, v. 30, June, pp. 698-704. (1 table, 26 references.)

12

VISUAL TRACTS AND CENTERS

McGavic, J. S. **Visual field defects due to head injuries.** Surg., Gynec. and Obst., 1947, v. 84, April 15, pp. 823-827.

The anatomy of the visual pathways and the methods of studying cerebral localization are reviewed. Interpretation of visual field defects following injuries is difficult. The defects that result from bone fragments may partially disappear after elevating the bone fragment. The trajectory of the foreign body may traumatize many pathways. Blood vessel injury may give a combination of vascular, cortical, and nerve fiber injury. Edema may cause transient effects. Brain abscess often appears as a late complication. The neuro-surgeon is handicapped in recognizing landmarks because of the small opening, edema, hemorrhage and contusion. The emotional instability of the patient, hysteria, malingering, difficulty of fixation when extraocular muscles are injured, involvement of auditory or speech areas, and damage to visuopsychic areas add to the difficulty of obtaining good visual fields.

H. C. Weinberg.

13

EYEBALL AND ORBIT

Cattaneo, Donato. **An unusual case of a foreign body in the orbit.** Ann. di Ottal. e Clin. Ocul., 1946, v. 72, May, pp. 257-260.

A 12-year-old girl who complained of diplopia for two months was found to have paralysis of the superior and lateral rectus muscles of the left eye. Recovery followed upon the removal of a splinter of glass 25 mm. long, which had evidently entered the orbit through the temporal fossa three years previously when the child fell against a glass door and shattered it. The base of the splinter was firmly imbedded in the outer wall of the orbit and its sharp tip was directed inward and downward. It is thought that the action of the temporal muscle gradually forced the splinter deeper into the orbit and that the slow growth of connective tissue around the foreign body explains the long delay in the appearance of symptoms. Harry K. Messenger.

Sherman, A. E. **Reconstruction of orbital floor defects.** Surg., Gynec. and Obst., 1947, v. 84, April 15, pp. 799-803.

The anatomy of the orbital floor is reviewed. Post-traumatic enophthalmos is usually due to severe displacement of the floor with or without destruction of the rim. The diagnosis is suggested by the history of trauma, depression of the eyeball with enophthalmos, diplopia, and anesthesia or hypesthesia of the infraorbital nerve. There

often is edema and if there is air in the soft tissues, crepitation is found. A palpably displaced fragment is often found and the diagnosis is verified by stereoscopic X-ray films. Loss of vision with this finding is suggestive of a fracture of the optic foramen. Early elevation of the fragments is desirable. An acrylic wedge is placed on the floor subperiostially and sutured in place. The eye is raised by sutures on the medial and lateral recti muscles. Large defects of the orbital rim are corrected by inserting a graft of shaped cancellous bone and small defects are corrected by the use of fascia lata. (17 figures.)

H. C. Weinberg.

Shaffer, Robert N. **Neuroblastoma of the adrenal with orbital metastases.** Amer. Jour. Ophth., 1947, v. 30, June, pp. 733-740. (5 figures, 7 references.)

14

EYELIDS AND LACRIMAL APPARATUS

Arcuri, Domenico. **Dacryocystorhinostomy.** Riv. Oto-Neuro-Oft., 1943, v. 20, July-Aug., pp. 241-274.

Reviewing thirteen types of lacrymal sac operations, their indications and contraindications, technical details and results are described. The author analyses his own 54 operations, performed on 49 patients and followed for a period of from one to four years. Arcuri uses the technique of Dupuy-Dutemps and sutures the mucous membrane of the sac to that of the nose; he stresses the importance of an ample opening in the bony wall; if suturing appears to be impossible he prefers dacryocystectomy. In most cases, however, apposition of the mucosa of the nose and the sac is possible. His series included 49 complete successes, two partial ones, and three failures. The latter were complicated by preceding peridacryocystitis.

K. W. Ascher.

Assettati, V. **Tuberculosis of the lacrymal glands.** Rassegna Ital. d'Ottal., 1943, v. 12, Jan.-Feb., p. 39.

Two cases of bilateral tuberculous disease of the lacrimal glands are reported. The writer gives several reasons for believing that the bacilli are carried in the blood stream: the frequent bilaterality of the disease, the benign course, probably due to low virulence of the organisms, the frequent failure to find the bacilli in microscopic sections, and the rarity of caseation and the frequency of fibrosis in areas.

An excellent review of the literature and discussion of etiology is given. (5 figures.) Eugene M. Blake.

Borsello, G. **The structure of the lymphatic follicles in the chronically inflamed lacrymal sac.** Rassegna Ital. d'Ottal., 1943, v. 12, May-June, p. 232.

A minute study of the various elements, such as the vascularization, connective tissue stroma and component cells of the nodules found in the chronically inflammed lacrimal sac are described. These changes are characteristic of the lymphatic tissues in defense and are interpreted as an hyperplasia of inflammatory character. There is a great similarity between these nodules and those which are found in true trachoma of the sac. (7 figures.)

E. M. Blake.

Lepri, Guiseppe. **Chancre of the lateral angle of the lids.** Arch. di Ottal., 1946, v. 50, Sept.-Oct., pp. 193-224.

Lepri describes one case of chancre of the lateral angle of the lids that oc-

curred at the same time as a probable chancre of the upper lip.

Francis P. Guida.

Spaeth, E. B. **Reconstruction of the upper lid.** Surg. Gynec. and Obst., 1947, v. 84, April 15, pp. 804-808.

Mucous membrane must be used in reconstructing the posterior surface of the lid in the presence of a functioning eyeball. Coarser epithelial grafts may be used in surgical anophthalmos. Correction of a defect of the posterior surface is essentially a reconstruction of a cul-de-sac with mucous membrane. The pedicle flap operation is to be used only when necessary and never as an operation of choice. It is valuable because of its larger size and greater viability. The ideal reconstruction of an entire upper lid can be obtained by utilizing the lower lid so that the tarsus of the lower lid becomes the tarsus of an upper lid. Lashes can be simulated by tattoo marks. A combined mucous membrane-epithelium graft is obtained by transplanting mucosa beneath the skin of the forehead and then later transplanting it to the site of the lid. The paper presents surgical principles of value in the more difficult problems of upper lid reconstruction. (10 figures.)

H. C. Weinberg.

Torres Estrada, Antonio. **Importance of replacement of the lacrimal puncta in treatment of senile ectropion.** Bol. del Hosp. Oft. de Ntra. Sra. de la Luz, 1946, July-Oct., pp. 185-199.

The author comments on the physiologic importance of rhythmic movements of the puncta in the normal act of winking, as described by Hörner. He remarks that senile ectropion begins with displacement of the lacrimal puncta, whereas, he declares, none of the classical methods described for surgical correction of senile ectropion is brought to bear actively on the lacrimal puncta. He describes his modification of the Kuhnt-Szymanowski operation. A small fusiform piece of the tarsus is resected parallel to the palpebral border and just below the punctum. If there is hypertrophy of the caruncle and of the semilunar fold, a part of these structures should be excised, and also a part of the subconjunctival fat if it tends to reduce the capacity of the lacus lacrimalis. (9 drawings.)

W. H. Crisp.

15

TUMORS

Wilder, H. C. **Intraocular tumors in soldiers, world war II.** Military Surg., 1946, v. 99, Nov., pp. 459-490.

Of 3882 eyes from men 18 to 38 years of age studied, 42 or 1.08 percent contained intraocular neoplasms. In seven eyes benign melanoma of the iris was found associated with malignant melanoma of the choroid. Six benign melanomas of the choroid were found in eyes removed because of penetrating wounds. There were 25 malignant melanomas and the less malignant melanomas are found in patients less than 40 years of age. Bilateral intraocular metastases from carcinoma of the lung, malignant melanoma of the skin, malignant dyskeratosis in a traumatic epithelial implant, von Hippel's disease, and malignant melanoma of the iris were also found. (1 table, 66 figures.)

Irwin E. Gaynon.

16

INJURIES

Nichelatti, P. **Extraction of nonmagnetic foreign bodies from the**

vitreous. Ann. di Ottal. e Clin. Ocul., 1946, v. 72, May, pp. 261-78.

The removal of nonmagnetic foreign bodies from the vitreous should usually be attempted, especially since techniques developed in conection with retinal tears make possible very exact localization.

Localization by X-ray is facilitated if a metallic ring with projections in the vertical and horizontal meridians is fitted over the cornea. To avoid separation of the retina the incision for the extraction of the foreign body should be made at the ora serrata or within the pars plana of the ciliary body. A meridional incision is usually advantageous. The operator is guided in his movements by the ophthalmoscope or by a spotlight or, if the media are not transparent, by a transilluminator. Care should be taken not to allow vitreous to bulge into the wound; the vitreous acts like a strong lens and may make it impossible to see the foreign body. Bulging of the vitreous may be prevented by gently separating the edges of the incision with the aid of loops of fine suture material placed 0.5 mm. from the incision on each side.

Removal of a foreign body is facilitated and should be undertaken if it is of recent origin, if it is situated near the sclera, and if the media are transparent.

Nichelatti adduces four reasons for attempting extraction even if the foreign body is thought to be of such a nature as to be well tolerated. The nature of the foreign body cannot always be known with certainty and therefore there is no assurance that it will be well tolerated. Many eyes react badly to foreign bodies that might be well tolerated in other eyes. Early removal lessens the risk of infection and may allow infection that has already started to be overcome. Carefully executed surgery is not more dangerous to the eye than expectant treatment. Extensive manipulation, however, should be avoided if the first attempt at extraction is unsuccessful. Harry K. Messenger.

Scholz, R. O., and Woods, A. C. **Relapsing and chronic ocular lesions following mustard gas burns.** Arch. of Ophth., 1947, v. 37, Feb., pp. 139-148.

One hundred and thirty-six cases of chronic and recurring mustard gas burns of the eye have been collected and analyzed. In the average case there were few, if any, complete remissions, and the condition progressed steadily over one or more decades to serious visual loss. Characteristically the lesions were bilateral and involved chiefly the exposed palpebral aperture. The conjunctiva was marbled in appearance, with ischemic areas surrounded by dilated, tortuous veins. Corneal ulcers, when they occurred, were shallow or deep, and frequently at the limbus although they occur anywhere. In some cases the scars became partially calcified.

No universal beneficial treatment has been reported. Curettage of the diseased corneal tissue and tarsorrhaphy seem to have been somewhat efficacious in shortening the duration of the relapse. The use of contact glasses to promote healing of the recurrent ulcers and to improve the patient's vision has been the most successful treatment reported. John C. Long.

Thorpe, H. E. **The management of nonmagnetic intraocular foreign bodies.** Surg., Gynec., and Obst., 1947, v. 84, April 15, pp. 809-822.

In every case of possible injury or

uveitis a careful history and an exhaustive examination of both eyes is indicated. Accurate localization by the technique of Vogt's skeleton-free X-ray films and a modification of Comberg's contact lens is discussed. Application of the magnet to determine whether the foreign body reacts to it is discouraged. The Berman locator is very useful. Prompt removal of foreign bodies before too much irritation and exudate appear is advised. Infection is combatted by the use of foreign protein, penicillin, and sulfadiazine. The methods of obtaining local anesthesia are described. The most desirable incisions for removing the foreign bodies are given and vary with the site. The ophthalmic endoscope of the author and its use are described. Postoperative treatment is described in detail. (17 figures.)

H. C. Weinberg.

17

SYSTEMIC DISEASES AND PARASITES

Brognoli, Carlo. **Various observations on ocular lesions of dental origin.** Arch. di Ottal., 1946, v. 50, Nov.-Dec., pp. 256-288.

Brognoli presents an extensive review of the literature on the theory of focal infection with special reference to the clinical and experimental work of Rosenow. Five cases of ocular disease are presented in detail; in each the lesion did not respond to the usual therapy but healed after dental treatment.

Francis P. Guida.

Capolongo, Giuseppe. **Ocular manifestations of smallpox.** Riv. di Oftalm., 1946, v. 1, Sept.-Oct., pp. 578-603.

Among 3500 patients treated for variola in the Domenico Cotugno Hospital in Naples, two became blind in one eye, and one, a six-year-old girl, in both eyes. There were 204 lesions of the conjunctiva, 293 of the limbus, 321 of the cornea and 20 of the uvea. Tables showing the numbers of prophylactically vaccinated patients prove the protecting power of vaccination although a certain percentage of variolous eye diseases was encountered in patients who had been successfully vaccinated. The general condition of the patient is of importance. Luetic and tuberculous affections may have occurred among those counted as smallpox complications. Treatment consisted of local and oral administration of sulfonamides in addition to the application of optochin, aniline dyes, and noviform in corneal disease. In some cases, instillation of penicillin solution (250 Oxford units per c.c.) proved to be highly beneficial; the value of the sulfonamides is unquestionable. The author stresses the fact that only the conjunctival pustules are really variolous in nature; corneal ulcers are always due to a secondary infection and therefore should be treated as in an individual not suffering from variola. (8 tables, bibliography.)

K. W. Ascher.

Contardo, R., and Peralta, A. **Ocular myiasis (Cochlyomia hominivorax).** Arch. Chilenos de Oft., 1946, v. 2, March-April, pp. 105-117.

With a brief review of the literature, and six illustrations, the authors report a striking case. The patient was a workman aged 82 years, who attributed his eye condition to a blow from a stick four days previously. He did not remember being bit by any insect. An odor of decomposed flesh was noticeable a number of meters away. There was great edema of both lids of the left eye, especially the upper, and the lower

lid was in large part destroyed. Using irrigations of a 30-percent watery solution of chloroform, numerous larvas, intertwined and lying in abundant pus, were removed from the orbital cavity. The eyeball had been reduced to a mere stump. The general and local condition of the patient improved under general and local use of penicillin, and internal use of sulfathiazole, but there was a considerable growth of bacillus proteus, which is not influenced by penicillin. The presence of this organism had to be combated with gramicin, a substance extracted from bacillus brevis. The larva found was the Cochliomyia Americana u hominivorax. It is a strict parasite, since to complete its cycle it must pass through a larval stage in a living organism, which for this species is man or another mammal. (6 illustrations, bibliography.) W. H. Crisp.

Cristini, Giuseppe. **Hemicrania ophthalmoplegica.** Riv. Oto-Neuro-Oft., 1943, v. 3, May-June, p. 154-164.

A 36-year-old soldier had had four attacks of ophthalmoplegic migraine at shorter intervals and in increasing intensity. After the last attack, a paresis of the third and seventh nerves and sensitivity of the fifth remained; these neurologic signs were cured after a course of acetylcholine injections over a period of three weeks. Mesencephalic vasomotor ischemia was considered the etiologic factor. K. W. Ascher.

Ferrié, J. and Grynfeltt, J. **Anatomical and clinical study of certain forms of sarcoidosis.** Ophthalmologica, 1946, v. 112, Oct.-Nov., pp. 193-225.

This study for which the authors received the "Catherine Hadot" prize from the University of Montpellier, is intended to clarify the relationship between sarcoidosis and tuberculosis. Three cases are described in detail:

(1) A case of Heerfordt's syndrome in a 41-year-old male, characterized by unilateral nodular iridocyclitis and sclerosing keratitis, bilateral preauricular chronic lymphadenitis and generalized chronic lymphadenitis, marked local and focal reactions to tuberculin and rapid improvement under treatment with the methyl-antigen of Nègre-Boquet which is a lipoid-free methyl alcohol extract of bovine and human tubercle bacilli (Ann. d'Ocul., 168: 624, 1931);

(2) A case of Mikulicz's syndrome in a male, 35 years of age, with strongly positive local reaction to tuberculin and spontaneous partial regression of the adenopathy;

(3) A case of benign cervico-mediastinal polyadenopathy in a 72-year-old white female (Schaumann's form of sarcoidosis).

Biopsies were taken from the affected glands of all three cases. The histological findings are described and shown in good photomicrographs. In the glands of case 1 and 2, well-organized tuberculoid tissue with epithelioid and giant cells was found. Necrosis was found only in material from case 3 and there only in a small area. A thorough search for acid-fast bacillus infections in section from all three cases revealed only one single acid-fast bacillus in the vicinity of the necrotic focus of case 3. Animal inoculations gave a negative result in all three cases. In the essayist's opinion, the three conditions exemplified by the three cases reported show sufficiently close relation to tuberculosis to support the view that sarcoidosis represents an atypical form of tuberculosis. P. C. Kronfeld.

Fields, Jack. **Ocular manifestations of mumps.** Amer. Jour. Ophth., 1947, v. 30, May, pp. 591-595. (16 references.)

Hartmann, E., and Braun-Vallon, S. **Ocular toxoplasmosis.** Ann. d'Ocul., 1946, v. 179, Oct., pp. 524-530. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Jedlowski, Paolo. **Hemiatrophia faciei progressiva.** Riv. Oto-Neuro-Oft., 1943, v. 20, Sept.-Dec., pp. 240-317.

Progressive facial hemiatrophy was studied in a 35-year-old man and in a 9-year-old girl; in the latter, the disease was preceded by vitiligo of her homolateral forearm. In both cases, the right side of the face was affected; in both patients, the atrophy appeared shortly after the onset of an unidentified gastrointestinal disease and was accompanied or preceded by paresthesia and by hypoesthesia in the region of the homolateral fifth nerve. Both patients showed the Claude Bernard-Horner syndrome, complete in one, and incomplete in the other patient. Hair and iris of the same side developed depigmentation in the child only. The differences between the right and left sides were not only obvious in the photographs and craniometric tables but also in the X-ray pictures. In the girl, the fundi and the intraocular arterial pressure were found to be normal and bilaterally equal. Galvanic and chronaximetric tests, however, revealed a marked difference between the normal and the affected side; some of the chronaxia readings were four and even six times higher on the affected side. These findings suggest that the disease is caused by an irritative lesion of the neurovegetative apparatus regulating the nutrition of the facial tissue. (6 figures, bibliography with more than 100 references.) K. W. Ascher.

Kindt, P., and Knudtzon, K. **Eye symptoms in poliomyelitis anterior acuta.** Acta Ophth., 1946, v. 24, pt. 3, pp. 295-322.

Of 37 patients who had brain stem symptoms with infantile paralysis, 23 had eye symptoms. These are reported in detail, and the literature is reviewed. Eye symptoms of various kinds are not uncommon with infantile paralysis. The eye affections in themselves are fairly benign and have a tendency to disappear spontaneously, but they are an expression of a dangerous poliomyelitis located high within the brain. It has a higher mortality rate than spinal poliomyelitis. For this reason eye symptoms are of diagnostic and prognostic value.
Ray K. Daily.

Lisman, J. V. **Dermatomyositis with retinopathy.** Arch. of Ophth., 1947, v. 37, Feb., pp. 155-158. (See Section 10, Retina and vitreous.)

Martens, T. G. **Exophthalmos of endocrine origin.** Am. J. M. Sc., 1947, v. 213, Feb., pp. 241-245.

This is a brief review of current ideas. In the average case of exophthalmic goiter the eye changes are relatively unimportant. Young adult females are affected more than males, there is little or no thyrotropic activity in the urine, and surgical therapy usually causes a decrease in any proptosis that may exist. Exophthalmos may occur with either hyperthyroidism or hypothyroidism, but more often in the former. It usually occurs in middle-aged adults of either sex with excessive thyrotropic activity in the urine. Surgical treatment is followed by an increase

in the proptosis and lid retraction. The exophthalmos is now thought to be of one type which differs only in course and degree, and the substance responsible for it and its control is the pituitary thyrotropic hormone. The actual means of production of the exophthalmos has not been completely elucidated. Some think that it results from progressive enlargement of the levator muscle and increase in volume of the orbital contents. Others ascribe the exophthalmos to excessive production of the thyroid-stimulating hormone by the pituitary. The latter causes the normal thyroid gland to hypertrophy and produce excessive thyroid hormone, which in turn causes a decrease in thyrotropic hormone. This is the mechanism of normal control. In progressive hyperthyroidism in the thyroid gland does not respond with increased production of hormone, consequently the pituitary continues to secrete, the exophthalmos increases, and finally irreversible changes occur in the ocular muscles. (References.) Bennett W. Muir.

Scuderi, Giuseppe. **Hemorrhagic allergy and the eye.** Rassegna Ital. d'Ottal., 1946, v. 15, Nov.-Dec., pp. 461-483.

The Schwartzman phenomenon consists of a necrotic and hemorrhagic reaction in the skin at the site of an intradermal injection of bacterial filtrate which occurs after an intravenous injection of the same filtrate 24 hours later. Sanarella produced a similar reaction in rabbits and guinea pigs by injecting vibrio colergeno intraocularly, and introducing 0.50 c.c. of the filtrate of colon bacillus into the veins one day later. Hemorrhages were found in the lids, conjunctiva and uvea but none in the vitreous, retina or cornea. The writer believes that the first injection acts upon the walls of the vessels of the eye to alter their resistance, so that the second injection results in extravasation of blood. Histologically one finds a diffuse leucocytic infiltration, thrombosis of veins, and extravasations of blood. (4 tables, 7 figures.)

Eugene M. Blake.

Swan, C., Tostevin, A., and Barham Black, G. **Final observations on congenital defects in infants following infectious diseases during pregnancy, with special reference to rubella.** M. J. Australia, 1946, v. 2, Dec. 28, pp. 889-908.

A fourth series consisting of 25 cases was studied. In 17 instances (one doubtful) the mother had contracted rubella in pregnancy; in one the mother had also suffered from chickenpox. Fifteen of the babies born subsequently exhibited congenital defects. The abnormalities included cataract, deaf-mutism, heart disease, microcephaly, umbilical hernia, bifid uvula, mental deficiency, epilepsy, speech defect, and concomitant strabismus.

Of the three subjects with eye defects, one suffered from bilateral cataract and two from concomitant strabismus; the mothers had suffered from German measles in the first, third, and fifth months of pregnancy, respectively. In addition to intermittent right concomitant strabismus the child was mentally defective and suffered from epileptic fits. A history of squint was obtained on both the paternal and maternal sides of the family in another case; two of the child's cousins suffered from the condition.

A summary of the investigations as a whole, carried out in South Australia during the years 1942 to 1946, precedes the discussion of this article.

Theodore M. Shapira.

Taylor, Charles. **A case of the Laurence-Moon-Biedl syndrome showing atypical retinitis pigmentosa associated with macular dystrophy.** Brit. Jour. Ophth., 1947, v. 31, April, pp. 211-215.

A case report of Laurence-Moon-Biedl syndrome is presented which shows the rarely-seen combination of atypical retinitis pigmentosa and macular dystrophy. The retina showed scattered pigment, and the macula was spotted with pigment. The vision was poor, and the "bone corpuscle" pigmentation was not predominant. Analyses of reported families revealed a high incidence of miscarriage and early death which indicates severe disturbances in the genes. O. H. Ellis.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Conde, Herminio. **Federal campaign against trachoma.** Rev. Brasileira de Oft., 1946, v. 5, Dec., pp. 89-102.

The author, who is ophthalmologist to the Health Division of the Brazilian Ministry of Education and Health, discusses objectives, development, epidemiology, and prophylaxis. Brazil has three distinct foci of the endemic, situated in the anterior of the states of Ceará, São Paulo, Rio Grande do Sul, and adjacent areas. The number of trachomatous persons in the country is estimated at 150,000, of which nearly a third have so far been given attention. The number of blind in the country from all causes, in 1946, was 72,000. Special characteristics influence the epidemiology in the several focal areas, such as climate, excessive luminosity, prevalence of flies, the presence of common ocular disorders (particularly chronic gonorrheal infection in the northern areas), special immigration groups, nutrition, and promiscuity. (Maps, statistical table, references.)

W. H. Crisp.

Esterman, Benjamin. **Some common ophthalmologic problems in pediatrics.** Med. Clin. North America, 1947, May, pp. 750-763.

The majority of eye diseases in children are first seen by the general practitioner and the pediatrician. The degree to which a cure may be attained depends greatly on the promptness in making the diagnosis and the beginning of the treatment. The most important eye conditions calling for prompt attention are strabismus, congenital dacryostenosis, and congenital cataract.

Ophthalmia neonatorum, interstitial keratitis, phlyctenular keratitis, vernal catarrh, foreign bodies, and injuries are adequately described and therapeutic measures which can be carried out by the practitioner or pediatrician are suggested. These suggestions are particularly intended for those who cannot readily send their patients to an ophthalmologist. Francis M. Crage.

Henberg, R. J. **Review of contributions of world war II to ophthalmology.** Ophthalmologica, 1946, v. 112, Oct.-Nov., pp. 292-302.

(See Amer. Jour. Ophth., 1947, v. 30, Jan., p. 75.)

James, R. R. **The development of medical studies in Britain: ophthalmology.** Brit. Jour. Ophth., 1947, v. 31, March, pp. 179-186.

English ophthalmology commenced with the Roman occupation of Britain. The thirteenth century saw the beginning of optics. The eighteenth century was the age of ophthalmic quackery.

The Moorfields Eye Hospital was established in 1805. This was quickly followed by similar eye hospitals in the provinces. In 1830 Mackenzie published his first textbook which was soon followed by many others. The Ophthalmological Society of the United Kingdom was established in 1881 with Bowman as president. One original member of the Society survives. Many operations and instruments were devised in that period; the names of Bowman, Elliot, Mules, Fergus, and Morton stand out prominently. Bowman was the first general surgeon to limit his work entirely to the eye. Morris Kaplan.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Daniel, P. **Spiral nerve endings in the extrinsic eye muscles of man.** J. Anatomy, 1946, v. 80, Oct., pp. 189-193.

Previously unrecorded simple spiral nerve endings encircling single muscle fibers, and multiple spiral nerve endings encircling single muscle fibers, are reported. It is suggested that these endings may be very simple modified muscle spindles that act as proprioceptors for recording changes in stretch or contraction of the muscles. It has not been possible to relate the encircling muscle fibrils found in normal extrinsic eye muscles to the encircling nerve fibers. A modification of the stain for reducing the background with the Gros-Bielschowsky method is suggested. (4 plates, references.)

Bennett W. Muir.

Sunderland, S., and Hughes, E. S. R. **The pupillo-constrictor pathway and the nerves to the ocular muscles in man.** Brain, 1946, v. 69, pt. 4, pp. 301-309.

An anatomical study of the ocular nerves with special reference to the pupillo-constrictor pathway lead the authors to believe that in the orbit and the anterior part of the cavernous sinus, the pupillary fibers may accompany the somatic fibers of the inferior division of the nerve, or may occupy a superficial independent position in the superior orbital fissure. Some fibers in the front part of the sinus may be associated with fibers of the superior division. Between the middle of the sinus and brain stem pupillary fibers are concentrated at the superior surface of the nerve. The presence of a sympathetic ganglion on the internal carotid is confirmed. Irwin E. Gaynon.

PAN-AMERICAN NOTES

Edited by M. Uribe Troncoso, M.D.
500 West End Avenue, New York 24

Communications should reach the editor by the 12th of the month

III Pan-American Congress of Ophthalmology

The board of directors of the Congress met recently in New York and approved several items as follows:

The Local Committee on Arrangements in Havana will consist of: Dr. Tomás R. Yanes, president; Dr. G. Cepero, general director; and Dr. Miguel A. Branly, general secretary. The meetings of the Congress will be held January 4 to 10, 1948, at the Building of the School of Medicine. The program will be officially closed on August 23, 1947. For authors who live north of Panama, summaries of 400 to 500 words should be sent to Dr. Miguel A. Branly, Edificio de la Escuela de Medicina, Calle 25 & I, Vedado, Havana, and another copy to Dr. Conrad Berens, 301 East 14th Street, New York, New York. For authors who live south of Panama, abstracts should be sent to Dr. Moacyr E. Alvaro, 1151 Rue Consolacao, S. Paulo, Brazil. The summaries of opening discussions of official subjects must be 200 to 300 words and should also be sent to the secretaries before August 23, 1947.

The Board decided that *Courses of Instruction* will be given at the same time as the Congress. These courses will be similar in scope to those of the American Academy of Ophthalmology and Otolaryngology. They are not intended for actual teaching, but for giving out information about the subjects in which the participants have a special interest. The director of each course will be the leader in discussions which will be held immediately after the lectures. The presentation time will be from 30 to 45 minutes. Each course will consist of three meetings of 20 attendants each, so that the course may be taken by 60 persons in all. The courses will take place from January 6 to 8, in the School of Medicine of the University of Havana. There will be 30 courses given in English and 20 in Spanish and Portuguese. The director of these courses must send to the general secretary a summary of his subject of from 400 to 600 words before August 23, 1947; so that it can be translated into other languages and slides can be made, if necessary.

There will be two exhibits, a scientific and a commercial one. Those who wish to take part in the first of these exhibits should address the director, Dr. Brittain F. Payne, 17 East 72nd Street, New York 21, New York. The commercial exhibition will be held at the same time as the Congress. Those interested in renting space should address Mr. Hector Uribe Troncoso, 301 East 14th Street, New York, New York.

Registration

Subscriptions for the Congress are now open. Those interested should send a postal order or bank draft for ten dollars ($10.00) to Dr. Miguel A. Branly, Edificio Escuela de Medicina, Calle 25 & I, Vedado, Havana, Cuba, to cover the quota for the Congress. In case the subscriber is not able to come to Havana there will be sent to him a copy of the *Transactions*, including papers, discussions, and so forth, when they are published. The hotel reservations will be made through Dr. Branly at the time of receipt of the subscription. While subscription fees need not be immediately sent in, hotel reservations cannot be made until they are received; the sooner subscription fees are received the easier it will be for the local committee to assign comfortable lodgings.

Travel

Members may obtain information about trip by railroad and boat by addressing Mr. H. E. Wright, Atlantic Coast Line Railroad, 217 S. E. 1st Street, Miami 32, Florida; or to the agents of the Seaboard Air Line Railroad in several cities.

Hotels

The hotels in Havana have quoted especially low rates ranging from $5.00 to $9.00 per person, according to the hotel selected. These rates are European plan. All rooms are outside, with bath.

	Single	*Double*	*3 in Rm.*
Hotel Nacional	$13.00	$18.00	$25.00
Hotel Sevilla-Biltmore	7.00	11.00	13.50
Hotel President	7.00	11.00	13.50
Hotel Plaza		10.00	12.00
Other Hotels	5.00	8.00	10.00

Intending members are reminded that it is essential that they send to Dr. Miguel A. Branly, Escuela de Medicina, 25 & I, Vedado, Havana, Cuba, a draft or order for ten dollars ($10.00) (U.S.) which is the amount of the subscription quota, in order to proceed to the hotel reservation in each case.

Post-convention trips

The Travel Department of Dussaq Co. Ltd., S. A., has been officially appointed to handle all sightseeing excursions throughout Havana and Cuba for members attending the convention. In addition to this, there have been arranged side-

excursions from Havana to Mexico, Guatemala, Panama, Brazil, Peru, Uruguay, Argentina, and Chile as well as to the United States for South American Members. For information and reservations regarding these postconvention trips you may write to Dussaq Co. Ltd., S. A., Tourist Dept., P. O. Box 278, Havana, Cuba. There will be a special travel section located at headquarters of the III Congress which will take care of accepting and confirming airplane and train reservations to all points above mentioned, as well as sightseeing trips in Cuba.

Miscellaneous

Appears in new format

The *Anales de la Sociedad Mexicana de Oftalmologia* now in their 5th Series have appeared in a new format with better paper and printing. The January-March, 1947, number contains the following articles. An editorial by Dr. Manuel Marquez on "Physiological Explanation of the Law of Hertig in Connection with the Double Innervation of the Internal Rectus Muscle;" "The Vogt-Koyanagi Syndrome," by Dr. Puig Solanes; "One Year at the Leper Sanatorium of Xoquiapan—Medical Review of Ophthalmological Subjects," by Dr. E. Graue; and "Thiouracil and its Derivatives in the Treatment of Thyrotoxicosis, Specially its Action on Exophthalmus."

Mexican bulletin published

Bulletin of the Ophthalmological Hospital N. S. de la Luz, Mexico City—The last two numbers of this journal corresponding to Vol. III, 1946-47, contain the following articles: Dr. A. Torres Estrada, "Importance of the Reposition of the Lacrimal Points in the Treatment of Senile Ectropion;" Dr. Teodulo Agundis, Jr., "Medical Treatment of Glaucoma;" Dr. Elcira Pinticart de W., "Tuberculin Therapy in Chile;" Dr. A. Torres Estrada's comment upon the paper "Tuberculin Therapy in Chile;" Dr. William H. Crisp, "The Technique of Refraction followed by Some North American Ophthalmologists;" Dr. A. Torres Estrada, "Indications of the Iridectomy in Hemiciclodialysis;" and Dr. A. Torres Estrada, "A Blindness of Forty Years Cured by Keratoplasty."

Monument to Dr. Carlos Charlin

A monument to the memory of Dr. Charlin, outstanding ophthalmologist of Santiago, Chile, recently deceased, was erected by the local ophthalmological society in the Eye Pavillion of the Hospital del Salvador. In an impressive ceremony speakers for the students of Dr. Charlin and some of the members of the society remembered his scientific contributions and his struggle for the advance of Ophthalmology in Chile.

Societies

Cuban ophthalmological society

The board of directors of this society for the period, 1946-48, will be: President, Dr. Lorenzo Comas; first vice president, Dr. Miguel Mery; second vice president, Dr. Rodolfo Hernandez; secretary, Dr. Oscar Horstmann; second secretary, Dr. Tomas R. Yanes; treasurer, Dr. Candido Duran; vice treasurer, Dr. Jose Ruiz Velazco.

First cuban congress

In January, 1947, the Ophthalmological Society organized a meeting for members all through the Island. It was presided over by Dr. Rodolfo L. Hernandez and had a good attendance. A symposium on "Surgical Techniques in Cataract Operation" and several individual papers were read and discussed. The society is officially organizing the meeting of the III Pan-American Congress of Ophthalmology in Havana January 4 to 10, 1948.

Personal

Visits the United States

Dr. Raul Argañaraz, professor of ophthalmology, University of Buenos Aires, and one of the outstanding ophthalmologists in that city, attended the meetings of the Section of Ophthalmology, American Medical Association, at Atlantic City, during the centennial convention of the society. He was introduced to the Section by the chairman, Dr. Derrick Vail. He then went to New York, where he visited some of the hospitals in the city, and from there to Chicago and to Canada, before returning to Argentine.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Raymond Edwin Elliott, Rochester, New York, died March 4, 1947, aged 56 years.

Dr. Edward Frothingham, Woodhaven, New York, died March 22, 1947, aged 54 years.

Dr. David Williams Henderson, Salt Lake City, died February 1, 1947, aged 65 years.

Dr. John Joseph McDermott, St. Joseph, Michigan, died March 19, 1947, aged 59 years.

ANNOUNCEMENT

FELLOWSHIPS AVAILABLE

The Heed Ophthalmic Foundation is offering a limited number of fellowships for advanced training in ophthalmology. Only those who have completed a minimum of two years specialized study in ophthalmology are eligible. United States citizenship is required.

Application blanks and additional information may be obtained from the secretary of the Board of Directors, Dr. M. Hayward Post, 520 Metropolitan Building, 508 North Grand Boulevard, St. Louis 3, Missouri.

MISCELLANEOUS

PRELIMINARY QUALIFYING TEST

At the last meeting of the American Board of Ophthalmology it was decided to replace the personal preliminary interview with a written qualifying test for all applicants. This is, in part, to save them the expense and time in traveling long distances where national meetings are held. The written test, therefore, was held simultaneously in many parts of the country on Wednesday, July 23rd. It will be given again during the winter, 1947-48. Candidates then qualifying will be admitted to the practical examination.

Registration for the Chicago examinations, October 7 to 12, 1947, limited to 60 candidates, has been closed.

PRESENTS GIFT TO HOSPITAL

Dr. Charles T. Thigpen, distinguished Alabama ophthalmologist for the past 50 years, has presented to the Medical College of Alabama the sum of $10,000 to be used for the conversion of one floor of the Jefferson Hospital into a complete ophthalmic hospital, with operating rooms, laboratory, clinic, residents' quarters and bed space for patients. This gift is in memory of his late nephew, Dr. Job T. Cater, who was associated with him in practice. The unit will be known as The Thigpen-Cater Ophthalmic Hospital.

HEED FOUNDATION FELLOWSHIPS

The Heed Ophthalmic Foundation has given its first fellowship, to be known as the Gradle Fellowship, to Dr. John C. Poore, now finishing his residency at the University of California, and the second to Dr. Herbert B. Shields, who has the same position at Washington University, St. Louis, Missouri.

SOCIETIES

A.O.S. OFFICERS

Following is the list of new officers elected at the recent annual meeting of the American Ophthalmological Society: President, Dr. Henry C. Haden; vice president, Dr. Bernard Samuels; editor, Dr. Wilfred E. Fry; secretary-treasurer, Dr. Walter S. Atkinson.

ELECTS NEW OFFICERS

At its final spring meeting, the Section of Ophthalmology of the New York Academy of Medicine elected the following officers for the coming year: Dr. Guernsey Fry, chairman; Dr. Maynard Wheeler, secretary.

PENNSYLVANIA OFFICIALS NAMED

The following officers have been elected by the Pennsylvania Academy of Ophthalmology and Otolaryngology for the ensuing year: President, Dr. Gilbert L. Dailey, Harrisburg; president-elect, Dr. James J. Monahan, Shenandoah; treasurer, Dr. Bruce A. Grove, York; secretary, Dr. Benjamin F. Souders, Reading.

SOCIETY HAS 68TH MEETING

The 68th meeting of the Reading Eye, Ear, Nose, and Throat Society was held on June 18th. It was an all day meeting with the following program:

10 to 11 a.m.—Surgical eye clinic

11 to 12 noon—Surgical and dry ear, nose, and throat clinics

11:30 to 12:30 p.m.—Dry eye clinic

1:15 to 2:15 p.m.—Benjamin F. Souders, M.D., demonstration of plastic implants and prostheses.

2:15 p.m.—Samuel J. Kopetzky, M.D., New York: "Therapy for Deafness."

5:30 to 6:30 p.m.—Study Session
David N. Farber, M.D., "Perimetry."
John J. Penta, M.D., "Some Interesting Lesions of the Tongue."

8 p.m.—James W. Smith, M.D., New York: "Ophthalmologic Office Procedures."

Look for This Sign GUILD OPTICIANS *or consult classified telephone directory*

OFFICIAL DIRECTORY

Guild Opticians

ALABAMA
Montgomery
SWENSSON OPTICAL SERVICE

CALIFORNIA
Berkeley
FRANKLIN OPTICAL CO.
Los Angeles
HEIMANN & MONROE
(3 Stores)
Modesto
FRANKLIN OPTICAL CO.
Oakland
FRANKLIN OPTICAL COMPANY (2 stores)
Pasadena
ARTHUR HEIMANN
Richmond
FRANKLIN OPTICAL CO.
San Francisco
JOHN F. WOOSTER CO.
Santa Barbara
SANTA BARBARA OPTICAL CO.
Vallejo
FRANKLIN OPTICAL CO.

COLORADO
Denver
SYMONDS-ATKINSON OPTICAL CO.

CONNECTICUT
Bridgeport
FRITZ & HAWLEY
THE HARVEY & LEWIS CO.
BERNARD J. O'DONNELL, OPTICIAN
WAKEMAN & ANDERSON
Danbury
CONRAD KASACK
New Britain
THE HARVEY & LEWIS CO.
New Haven
FRITZ & HAWLEY
THE HARVEY& LEWIS CO.
CONRAD KASACK
Hartford
LOWRY & JOYCE
THE HARVEY + LEWIS CO.
Ridgefield
FRANCIS D. MARTIN
South Norwalk
NORWALK OPTICAL CO.
Stamford
CLAIRMONT-NICHOLS, INC.
THEODORE H. LEUZE
Waterbury
WILHELM, INC.

DELAWARE
Wilmington
BAYNARD OPTICAL CO.
CHAS. M. BANKS OPTICAL CO.
CAVALIER & CO.

DISTRICT OF COLUMBIA
Washington
EDMONDS, OPTICIAN (2 Stores)
FRANKLIN & CO.
HILL & DUVALL
HUFFER-SHINN OPTICAL CO.
MEDICAL CENTER OPTICIANS
RHODES, OPTICIAN
TEUNIS BROTHERS

FLORIDA
Jacksonville
JACKSON OPTICAL DISP'NS'RY
Miami
HAGELGANS OPTICAL CO.

GEORGIA
Atlanta
WALTER BALLARD OPT. CO.
(3 Stores)
KALISH & AINSWORTH, INC.
KILBURN'S
Augusta
TWIGGS PRESCRIPTION OPTICIANS
Savannah
HODGE OPTICAL CO.

IDAHO
Boise
GEM STATE OPTICAL CO.

ILLINOIS
Chicago
ALMER COE & CO.
J. H. STANTON
Evanston
ALMER COE & CO.

INDIANA
Indianapolis
PERROY, INC.

KENTUCKY
Louisville
THE BALL OPTICAL CO.
MUTH OPTICAL CO.
SOUTHERN OPTICAL CO.
(2 Stores)

LOUISIANA
New Orleans
BARNETT & CARLETON
HELMUTH HORNUFF, OPTICIAN

MARYLAND
Baltimore
BOWEN & KING, INC.
BRADLEY & HERBERT
O. HARRY CHAMBERS, INC.
CHAS. A. EUKER
A. L. KNOWLES
WISE & VOLKER, INC.

MASSACHUSETTS
Boston
CHILDS, CARL O.
DAVIDSON & SON
EDWARD W. HELDT
ANDREW J. LLOYD CO.
(3 Stores)
MONTGOMERY FROST CO.
(4 Stores)
HENRY O. PARSONS
Cambridge
ANDREW J. LLOYD COMPANY
Framingham
THE OPTICAL CO.
Greenfield
SCHAFF, OPTICIAN
Holyoke
CHENEY & HUNT, INC.
Springfield
J. E. CHENEY & STAFF, INC.
CLARKE, ALBERT L.
THE HARVEY & LEWIS CO.
PHILIP E. MURPHY
Waltham
BENNET R. O'NEIL, OPTICIAN
Woburn
ARTHUR K. SMITH
Worcester
JOHN C. FREEMAN & CO.
THE HARVEY & LEWIS CO.

MINNESOTA
Minneapolis
M. J. CARTER
Rochester
A. A. SCHROEDER
St. Paul
ARTHUR F. WILLIAMS

MISSOURI
Joplin
PHYSICIANS OPTICAL DISPENSARY, INC.
St. Louis
ERKER BROS. OPTICAL CO.
(2 Stores)
GEO. D. FISHER OPTICAL CO.
(2 Stores)
JOHN A. GUHL, INC.

NEW JERSEY
Asbury Park
ANSPACH BROS.
Atlantic City
ATLANTIC OPTICAL CO.
FOERSTER OPTICAL CO.
FREUND BROTHERS
Camden
E. F. BIRBECK CO.
HARRY N. LAYER
J. E. LIMEBURNER CO.
PELOUZE & CAMPBELL
East Orange
ANSPACH BROS.
H. C. DEUCHLER
JAMES J. KEEGAN
Elizabeth
BRUNNER'S
JOHN E. GAVITT
Englewood
HOFFRITZ, FRED G.
Hackensack
HOFFRITZ & PETZOLD
Irvington
LOUIS P. NOSHER, DISPENSING OPTICIAN
Jersey City
WILLIAM H. CLARK
Montclair
STANLEY M. CROWELL CO.
MARSHALL, RALPH E.
Morristown
JOHN L. BROWN
Newark
ANSPACH BROS.
EDWARD ANSPACH
CLINTON OPTICAL SERVICE
KEEGAN, J. J.
MEDICAL TOWER OPTICIANS, INC.
REISS, J. C.
CHARLES STEIGLER
JESS J. WASSERMAN & CO.
Paterson
COLLINS, J. E.
Plainfield
GALL & LEMBKE
LOUIS E. SAFT
Ridgewood
RAY GRIGNON, OPTICIAN
Summit
ANSPACH BROS.
H. C. DEUCHLER
Trenton
GEORGE BRAMMER, OPTICIAN
Union City
ARTHUR VILLAVECCHIA
RICHARD VILLAVECCHIA
Westfield
BRUNNER'S
Wood-Ridge
R. T. KNIERIEM & SON

NEW YORK
Albany
PERRIN & DI NAPOLI
Babylon
PICKUP & BROWN, INC.
Baldwin, L. I.
FRANCIS D. GILLIES
Bronxville
SCHOENIG & CO., INC.
A. R. TRAPP, INC.
Buffalo
BUFFALO OPTICAL CO.
(3 Stores)
FORREST-GOULD OPTICAL CO.
FOX & STANILAND, INC.
(2 Stores)
FRANK & LESSWING OPT. CO.
GIBSON & DOTY
PRECHTEL OPTICAL CO.
PAUL C. RUEHL
SCHLAGER & SCHLAGER
FREDERICK J. TERNHORST
URSIN-SMITH GUILD OPTICIANS
NORMAN E. VANDERCHER
Kenmore
BUFFALO OPTICAL CO.
GIBSON & DOTY
New Rochelle
BATTERSON, INC., JOHN P.
New York City
AITCHISON & CO.
EDWARD J. BOYES
CLAIRMONT & NICHOLS CO.
FRYXELL & HILL
GALL & LEMBKE
HALPERT & FRYXELL, INC.
HARTINGER, EDWARD T.
A. HAUSTETTER, INC.
HOAGLAND, J. S.
LUGENE, INC. (2 Stores)
MARTER & PARSONS
E. B. MEYROWITZ, INC.
(6 Stores)
PAGE & SMITH
H. L. PURDY, INC.
SCHOENIG & CO., INC.
A. R. TRAPP, INC.
Brooklyn
HERBERT E. ALDERMAN, INC.
BADGLEY, H. C.
BECHTOLD & CO., INC.
DOUDIET, ERNEST A.
J. B. HOECKER, INC.
E. B. MEYROWITZ, INC.
J. H. PENNY, INC.
NORTON & SCHNEIDER, INC.
A. M. SHUTT
V. R. TEDESCO
Flushing
BERNARD SHOLKOFF
Garden City
J. H. PENNY CO., INC.
Hempstead
C. WALTER SEE
Jamaica, L. I.
HANSEN, JOHN
Niagara Falls
GEORGE OPTICAL CO.
Rockville Center
SCHOENIG & CO., INC.
Staten Island
VERKUIL BROTHERS
Rochester
WILLIAM J. HICKEY
WALDERT OPTICAL CO.
WHELPLEY & PAUL
Rye
A. E. REYNOLDS
Schenectady
DAY, JAMES E.
OWEN OPTICAL COMPANY
Syracuse
CARPENTER & HUGHES
CLOVER-WHITE OPT. CO.
EDWARD HOMMEL & SONS
Troy
WILLIAMS—OPTICIAN
Utica
KRYSTOL OPTICAL CO.
Watertown
ROBERT L. MEADE
White Plains
CLAIRMONT & NICHOLS CO.
JOSEPH E. KELLY
SAMUEL PEYSER
Yonkers
MILLER & MILLER PROFESSIONAL OPTICAL SHOP

NORTH CAROLINA
Fayetteville
McBRYDE'S-OPTICIANS

OHIO
Akron
VORWERK PRESCRIPTION OPTICIANS
Cincinnati
ETTER BROTHERS
KOHLER & CO.
SOUTHERN OPTICAL CO.
TOWER OPTICAL CO.
Cleveland
CHARLES F. BANNERMAN
HARRY BRAY OPTICAL CO.
E. B. BROWN OPTICAL CO.
RICHARD H. EBNER
HABERBRACKER OPTICAL CO.
HENRY J. PORTER
REED & McAULIFFE, INC.
Columbus
PHYSICIANS OPTICAL SERVICE
Lakewood
HABERBRACKER OPTICAL CO.
REED & McAULIFFE, INC.
Toledo
PRESTON SADLER

OREGON
Portland
MOOR, HAL. H.

PENNSYLVANIA
Allentown
L. F. GOODIN
Ardmore
WINFIELD DONAT CO.
WALL & OCHS
Bethlehem
PRICE, WILLIAM H.
Bryn Mawr
J. E. LIMEBURNER CO.
Erie
ERIE OPTICAL CO.
HESS BROS.
WILLIAM J. MAGAY CO.
E. K. MEYERS
Homestead
L. E. NEWLAND II, OPTICIAN
Jenkintown
WINFIELD DONAT CO.
J. E. LIMEBURNER CO.
Norristown
J. E. LIMEBURNER CO.
K. E. PALMER
Philadelphia
BENDER & OFF
BONSCHUR & HOLMES, INC.
(2 Stores)
A. W. BRAEUNINGER, INC.
JOHN W. CLEARY
WINFIELD DONAT CO.
(2 Stores)
DOYLE & BOWERS
JOSEPH C. FERGUSON JR., INC.
J. E. LIMEBURNER CO.
(2 Stores)
RALPH H. MACMURTRIE
MAWSON & KIENLE
FRANK A. MORRISON
MULLEN & WOLF
MULLER & FENTON
WILLIAM J. SCOTT, INC.
WILLIAM S. REILLY
THE WM. F. REIMOLO CO.
SIGISMUND STREET, LINDER & PROPER
WALL & OCHS (3 Stores)
WELSH & DAVIS
WILLIAMS, BROWN & EARLE, INC.
JOSEPH ZENTMAYER
Pittsburgh
DAVIDSON & CO.
DUNN-SCOTT CO.
B. K. ELLIOTT CO.
GEO. W. HASS, INC.
F. J. MALONEY
OSCAR P. MATOUS, OPTICIAN
CHARLES F. O'HANLON
SHALER & CRAWFORD, INC.
GEO. B. REED & CO.
HOMER J. SABISH, OPTICIAN
Upper Darby
J. E. LIMEBURNER CO.
West Chester
WINFIELD DONAT CO.
Wilkinsburg
DAVIDSON & CO.

TEXAS
Houston
BARBOUR'S PROFESSIONAL OPTICIANS

VIRGINIA
Lynchburg
BUCKINGHAM & FLIPPIN
A. G. JEFFERSON
Newport News
WHITE OPTICAL CO.
Norfolk
E. E. BURHANS OPTICAL CO.
SMITH & JOHNSON OPTICAL CO., INC.
Portsmouth
JOHNSON OPTICAL CO.

WASHINGTON
Bremerton
WESTERN OPTICAL CO.
Seattle
CHARLES R. OLMSTEAD
WESTERN OPTICAL DISPENSARY
Yakima
PHYSICIANS OPTICAL CO.

WEST VIRGINIA
Charlestown
S. A. AGNEW
Parkersburg
RAWLINGS OPTICIANS, INC.
Wheeling
RAWLINGS OPTICIANS, INC.

CANADA
Hamilton
W. E. DAVIES
Montreal
R. N. TAYLOR & CO., LTD.
Ottawa, Ontario
O. L. DEROUIN
GEO. H. NELMS
SUTHERLAND & PARKINS
Toronto
FRED SHORNEY, LTD.
J. C. WILLIAMS
Winnipeg
RAMSAY, ROBERT S.